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Electrical Navigation. A GOOD many interesting efforts have been made in the field of electrical navigation, most, if not all, of which have been illustrated in our pages. This week we present some details and a sketch of an electric catamaran which has been run this summer with success on Lake Conemaugh in Pennsylvania. She appears to be a handy little craft, and there is no reason why plenty more of the same type should not be found on our inland waters, and at seaside resorts.

Western Union Earnings. OFTEN a cause of weakness to the whole range of stocks, Western Union just now is the mainstay of the bulls. The estimated net revenues for the current quarter are the largest since June, 1884, and are at the rate of over 6 per cent. The earnings would be larger but for the reduced rates; and the present increase in volume of business is likely to go on. In fact, the company bids fair to be so prosperous that opposition may once more be tempted to lift its head.

Telpher Lines. IT has been a matter of wonder to us that greater extension has not been given to telpherage. The system devised by the late Fleeming Jenkin has been working at Glynde, in England, for about two years, but otherwise the invention seems to have been in a state of arrested development. Now, however, our English correspondent reports that two telpherage lines have been ordered for some tin and copper mines in Cornwall. We believe that in this country the opportunities for the profitable introduction of such a system are numerous, especially in the mining regions of the West, and we are glad to see that one of the motor companies proposes to devote its attention to this class of work.

Alternating Currents. THE controversy over the various questions connected with the introduction of alternating currents, their economy and their danger, continues to be waged with unabated vigor. It must be said that few subjects have shown such a capacity for exciting general interest and bringing out new points of importance at each stage. This week our columns are rich in contributions to this subject. Not only do we give a vivacious reply from the irrepressible Mr. Brown to some of the attacks recently made upon him and his experimental methods, but we have a very interesting article from Dr. Vander Weyde on alternating electrolysis. We give also a brief illustrated description of a new alternating current motor which has just been brought out in England.

Jacksonville Heroes. THE fact that such constant and full communication has been maintained between fever-stricken Jacksonville and the outer world, shows that the telegraphic force there has been true to its duty. The yellow fever has thinned the ranks, but the men have persevered nobly, stimulated by the example of Superintendent B. F. Dillon, Mr. W. J. Wallace, the day chief, and Mr. J. P. Rivers, the night chief. Mr. Dillon has now been stricken, but the work goes bravely on. In the telephone office, too, similar efforts to keep up the service have been made, and the memory of Miss Kidd, the chief in the Exchange, and of those who held out with her, till the fever seized them, will be cherished by the people of Jacksonville. These times of pestilence in the South have always found their heroes in the electrical ranks.

Electricity in Japan. IT is reported from Japan that an electrical society has been formed there, and that its membership is no less than 800 at the start. We hardly know how to receive this piece of intelligence. If it be true, it would indicate, first, that Japan had gone much further in electrical study and development than had been supposed, and next that admission to the society is based on very liberal rules and regulations. At the present time the ranks of our American engineers are largely and valuably reinforced from England and the continent of Europe, but here we have the intimation that, perhaps, before long Japan will also be supplying us with experts for our parent and local companies in all lines of work. We are glad to see that such a society has been formed in Japan, and we trust that it will be growingly useful and prosperous.

An Electric Cable Road. REPORTS come from Switzerland of a novel combination of the electric and cable systems on a road up the Burgenstock. Current is transmitted three miles to the road, from a couple of 25 h. p. dynamos driven by water power, and the dynamos, charging accumulators for the purpose, operate two motors stationed at the head of the road, which is 938 metres in length. The motors are connected with and drive a rope system which hauls two cars up and lowers them. Each car will carry 50 or 60 persons. It might be mentioned that the same water power furnishes current for lighting the big hotel and pumping up spring water by motor, but the chief point to us lies in the suggestiveness of the first application. Such a plan as this might well be adopted on street car lines which happen to include a steep grade or two, for it would certainly avoid the necessity of subordinating the whole plant to the requirements of a few short sections.

Liability for Forged Telegrams. IT appears that the Supreme Court of Minnesota has ruled that a telegraph company is liable for the fraud practiced by its agent, who sent a false message, prepared by himself, to a merchant asking him to forward money by express to be used for buying grain. On the arrival of the money, the operator, who was also express agent, stole it and converted it to his own use. The court held that the forgery was virtually that of the company, being committed by its agent in the ordinary discharge of business. Such a case as this appears to bear rather harshly on the company, but the principle of of protecting the public would apply, it seems, as much here as in the case of a railway accident, where the company finds itself responsible sometimes for millions of dollars of damage caused by the carelessness or neglect of an official. The right course for the company to pursue is to secure good men, pay them well, and then to have their honesty guaranteed by some of the institutions founded for the purpose.

Motors versus Compressed Air. OUR Western correspondent makes a note of the fact that Mr. George Cutter, the electrical engineer, of Chicago, who has recently been making a trip through the copper regions of the North, was impressed with the fact that if the electric motor were used in the mines there in the place of the compressed air system, it would do away with many of the delays now caused by the use of the latter method. The point is a good one. Mr. Cutter is probably not only right as to the great adaptability of the motor to such work, but we believe that figures would show its superior safety and economy. Mr. Cutter's notes on the subject of his trip, discussing the general features of the copper region, are so interesting that we are glad to give them in this issue.

Political Phonographs. IN the present strained relations between this country and Canada, the use of the phonograph as a means of delivering political speeches on the other side of the border assumes importance; hence the attention which has been paid to the amusing effort on the part of Mr. Erastus Wiman to avoid an interdict laid upon him by the managers of the industrial exhibition at Toronto. Mr. Wiman, it is said, was to deliver a speech on the beauty and advantages of commercial union with the United States, but the authorities interfered with the plan, whereupon it was suggested that Mr. Wiman should orate to the Edison phonograph which was to be exhibited, so that the speech with which it was charged before leaving New York could be repeated into Canadian ears without let or hindrance. This little dodge for "whipping the devil around the stump" was discovered, and Mr. Wiman was requested to find some other theme for his eloquence. We are not informed as to the exact termination of the episode, but it is understood that the utterances of the phonograph when it was introduced to the admiring Canadian audience, had, after all, a political tinge.

The Electric Light Association. A NEW period in the history of the National Electric Light Association opened with the recent meeting in this city—a period with new problems, new responsibilities, and, it might be said, new men. The members were wise, however, not to break entirely from old ties and traditions by changing the name of the body, and Dr. Moses and Mr. Alexander deserve thanks for the timely interposition of their eloquence and advice in preventing the adoption of a title so broad and vague as to sacrifice identity with lighting interests without the gain of anything even as compensation. As to the desire for what are called "permanent headquarters" and a secretary who shall devote his whole time to the work, that seems natural in view of the growth of the Association and the increase in the secretarial duties. At the outset, the Association will assume a burden not light, and one which justified the anxiety expressed by Mr. Morrison, who has done so much to bring the Association up to its present creditable standard of membership and influence. Still, the success of the effort should be its own vindication, and all may rest assured that President Duncan, with whom the new departure originates, will work for the full realization of his laudable plans and ideas.

New York Street Cars. IT is, we think, impossible to exaggerate the importance of the work now being done on the Fourth avenue in the introduction of electric street cars. There are many features special to this piece of work, giving it unusual prominence and significance. New York City, to begin with, is peculiarly suitable for demonstrations of an improvement of this character, and our firm conviction is that the more the public see of the storage cars the more they will insist upon having them. So far as the public is concerned, the element of expense does not enter into the matter any more than it does into the agitation against bobtail cars. It is enough that the cars are swift, clean and safe, easily controlled, do not in the slightest degree affect the paving of the roadbed, save the horses from a cruel fate, abolish the malodorous car stables, lighten the work of the drivers, and are free from all the objections that can be raised against either the steam elevated road or the surface cable cars. On the other hand, storage cars *are* cheaper than horse cars to run, and that is the main point for the operating companies; while there is another enormous advantage in the fact that the change from the old system to the new can be made gradually. Then, again, the adoption of storage for such a road as the Fourth avenue is a very hopeful and cheering sign, not only of the liberal policy marking the Vanderbilt régime of to-day, but of the prospects of electricity in urban passenger traffic generally. If storage cars thus find favor with one of the largest and most conservative managements in the country, one may well be sanguine as to the future. We have but one criticism to offer on the new cars, suggested by the successful trials of Saturday last, namely, that they are almost too massive and handsome. Perhaps it is not our business, but still we believe that the car bodies might be built much lighter without losing stability.

The British Association Meeting at Bath.

Special Cable Dispatch to THE ELECTRICAL WORLD.

BATH, Eng., Sept. 12.—In supplementing my previous dispatch on the meeting of the British Association, which has just closed here, I should remark that the meeting will be memorable chiefly for the theoretical papers presented. The discussion on the relations of light and electricity has been of the greatest interest, being participated in by such distinguished men as Sir William Thomson, Lord Rayleigh, Prof. Rowland and Prof. Fitzgerald; and large contributions were made to the advanced theory on the subject. The discussion on lightning conductors, by sections A and G jointly, has also been very interesting, opening with a brilliant attack on Dr. Lodge's theories by Mr. Preece; but the chief speakers supported the views that Dr. Lodge has identified himself with. In applied science, the papers presented have elicited little that was novel. We have had Prof. Forbes on the Westinghouse system in America, and Mr. Crompton on another American topic, the Cowles process for obtaining aluminum. Mr. Lowrie gave a paper on alternating meters, and Mr. Sellers on navigation of the Suez Canal by the aid of electricity. The lecture by Prof. Ayrton on the electrical transmission of energy was, like its predecessors, a brilliant success, especially that part of it which related to electric welding.

Telegraphy with Superposed Pulsatory and Undulatory Current Signals.—III.

BY WM. MAVER, JR.

With the knowledge of what had been done or suggested in the matter of simultaneous telegraphy and pulsatory current signals, prior to the introduction of the Bell telephone in 1876, it is evident that when the electrical transmission of speech became an accomplished fact, the question as to the possibility of utilizing the existing telegraph wires for telephonic purposes, simultaneously with the transmission of telegraph signals, was carefully considered by those interested.

It is on record that as early as 1877 experiments were made in Dresden, which demonstrated that the telegraph wires could be used for the double purpose of telegraphy and telephony; but it is not stated in the records at my command whether these wires could be used for that double purpose at one and the same time, nor, if the latter was the case, are we informed what measures, if any, were taken to prevent the effect of the abrupt rise and fall of the telegraph currents upon the telephone receiver.

It does not appear that much of practical value was done to bring about this result until Professor Van Rysselberghe attempted its solution. It was known that mutual induction from parallel lines, which at once jumped into prominence as an obstacle to telephony, especially long

FIG. 11.—MAICHE SYSTEM OF SIMULTANEOUS TELEGRAPHY AND TELEPHONY.

distance telephony, could be very measurably obviated by using metallic circuits and twisting or cross connecting the wires; but when those wires were to be used for telegraph purposes also, it was plain that some efficient means must be adopted for silencing the telegraph currents in the telephone.

In the search for such efficient means Professor Van Rysselberghe has undoubtedly been the most successful, but others have also succeeded in devising methods of accomplishing this result, and before taking up the consideration of the Van Rysselberghe method, and prior to relating some personal experiences had therewith, I shall describe one or two other and quite different means than those employed by him, for preventing the harmful effects of the telegraph currents in the telephone receiver, for some information concerning which I am indebted to an article by M. Rothen in the *Journal Telegraphique*.

Fig. 11 illustrates an arrangement for this purpose, devised by M. Maiche. The wires 1 and 2 may be supposed to connect the stations *A* and *B*. *M M'* are induction coils, each of which is furnished with two primary coils *P P'* and one secondary coil *S S'*. The latter coils compose part of the circuit of telephone transmitting and receiving apparatus, of which *T T'* are the microphone transmitters and *t t'* the telephone receivers, the switch connections not being shown. The primary coils are wound in opposite directions around their respective cores. The wires 1 and 2 are connected at the points *X* and *X'* to single wires, in which are included the ordinary Morse relays *R R'*, keys *K K'*, and batteries *b b'* of a Morse telegraph set. Inasmuch as the telegraph current will divide equally between wires 1 and 2, and as they will pass through the primary coils in opposite directions, they will have no effect on the secondary coil, and this will not be felt in the telephone. Perhaps this will be more readily understood by assuming that the primary coils *P P'* correspond to the main and artificial line coils of a differential duplex relay and the secondary coil *S* to the core of that relay. If then

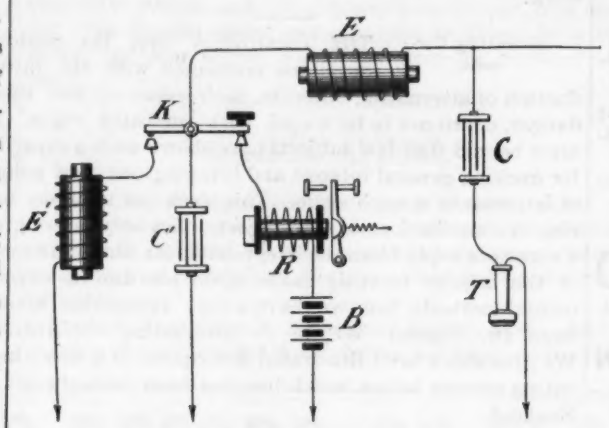


FIG. 12.—VAN RYSSELBERGHE SYSTEM.

the wires 1 and 2 are of equal resistance the telegraph batteries will not affect the secondary coil. On the other hand, the telephone currents set up in the secondary coil will originate currents in coinciding directions in the primary coils, which, traversing the metallic circuit contained within the points *X X'*, will induce currents in the distant induction coil, which will be reproduced in the telephone receiver. In this way the telegraph currents are silenced in the telephone and simultaneous telegraphy and telephony is made possible. It may be said that it would be somewhat difficult to produce absolute silence in the telephone in this way, as that necessitates a perfect electrical balance between the two wires and the primary coils, but it would perhaps be sufficiently so for practical working. A resemblance between this arrangement and one of the several Rosebrugh duplex telephone systems will be noticed, M. Maiche having, it would seem, substituted a telegraph apparatus at each station for the second telephone of the Rosebrugh duplex. In any event it is not likely that this particular method of simultaneous telegraphy and telephony will be very largely availed of in view of the fact that it requires two wires for one telegraph circuit.

Another system of simultaneous telegraphy and telephony, described, not very fully, in the *Journal Telegraphique*, has been devised by M. Tommasi. This gentleman proceeds on the assumption that by using telegraph currents so feeble that they will not act detrimentally on the telephone receiver, and then providing exceedingly sensitive telegraph receiving instruments, he will have solved the problem. The telegraph relay for this purpose "consists of a magnetic needle which oscillates between four solenoids. The current of the line traverses the solenoids and the action on the needle is thus quadrupled. The needle, in deviating from its position of rest, closes a local circuit, and thus may be operated on telegraph circuits employing very weak currents, not sufficient to interfere with the reception of speech in the telephone receiver. The telephone is separated from the telegraph line in the usual way by means of a condenser, and a resistance eight times greater than that of the line is inserted in the telegraph circuit between the telegraph apparatus and the point in connection of the telephone circuit." This system is said to have been operated successfully between Paris and Nantes and Paris and Laon.

There is no doubt that a delicately sensitive relay, as thus outlined, could be constructed, but its very sensitiveness would, on this side of the Atlantic at least, be its greatest objection, unless it should be intended to use the system between points where no other telegraph or electric light company would be permitted to exist; otherwise the inductive effects from such circuits would, it is to be feared, prove fatal to the success of the Tommasi plan.

As in the case of the solution of many other problems by different persons, Prof. Van Rysselberghe's solution of the one requiring the silencing of the telegraph currents in the telephone to permit simultaneous telegraphy and telephony, was suggested to him in an accidental manner. It had first been his intention to increase the power of the telephone transmitter and decrease the sensitiveness of the receiver. One day while experimenting with a view to utilizing certain telegraph wires for telephonic purposes, the Professor noticed that the noises in the telephone were much less pronounced than usual. On investigating the cause he learned that a defect had occurred in the transmitting machinery of a Hughes printing telegraph, the effect of which an investigation showed was to cause a gradual make and break of the telegraph current. This led Professor Van Rysselberghe to seek to reproduce artificially a gradual make and break of the telegraph circuits. The first means he employed to bring about this result was a transmitting key which, in opening and closing, gradually threw resistance in and out of the circuit. This arrangement was not, however, very successful, and subsequently the professor adopted a combination of electro-magnets and condensers, by means of which it was found quite possible to render the telegraph currents practically inaudible in the most sensitive telephones.

This combination of electro-magnets and condensers Professor Van Rysselberghe terms "graduators."

The arrangement of these graduators for a simple Morse circuit is shown in Fig. 12. The relay *R* is placed between the battery *B* and key *K*. An electro-magnet *E* is placed in the line and another, *E'*, is placed between the back contact of the key and ground. A condenser *C'* is inserted between the key *K* and ground, as shown.

The telephone apparatus, of which only the receiver *T* is shown, is separated from the main line by the condenser *C*, which is technically termed a "separator." In this way, as in some of the "pulsatory" systems already described, the telegraph system is not interfered with nor encumbered, so far as the telephonic system is concerned, excepting as regards the increase of electro-static capacity due to the condenser *C*, which, however, need not be very great.

The resistance of each of the electro-magnets *E E'* is about 500 ohms. The helices are usually enclosed by an iron tube which is brought flush with the ends of the core. These electric magnets, by retarding the free flow of the current into the wire at the "make" of the circuit and by prolonging the current by their own discharge at the "break" of the circuit, constitute, as might be expected, a very efficient means of graduating the rise and fall of the telegraph currents. The condenser *C'* still further "graduates" the telegraph currents by taking up a portion of the charge at the making of the circuit and giving it out at the breaking thereof.

It will be manifest that in the adoption of this method of silencing the telegraph currents in the telephone, that is, by rendering the rise and fall of the currents gradual, Prof. Van Rysselberghe has, at the same lime, eliminated very measurably the inductive effects between parallel wires, inasmuch as it is the abrupt rise and fall of the electro-magnetic lines of force which set up perceptible induced currents in adjoining conductors. We know that when a current is set up in one conductor, for instance *A*, Fig. 13, a galvanometer *G*, placed in a parallel conductor *B*, would show that a momentary current is generated therein, and when the circuit in the first conductor *A* is broken, a momentary current is induced in *B* in the opposite direction to that of the first momentary current; these momentary currents in *B* being caused by the lines of force which emanate from *A* rapidly "cutting" the conductor *B* in their abrupt rise and fall. This method of generating currents may be said to be the reverse of that in which a current is generated in the ordinary dynamo-electric machine. In the case of the latter it is known that with

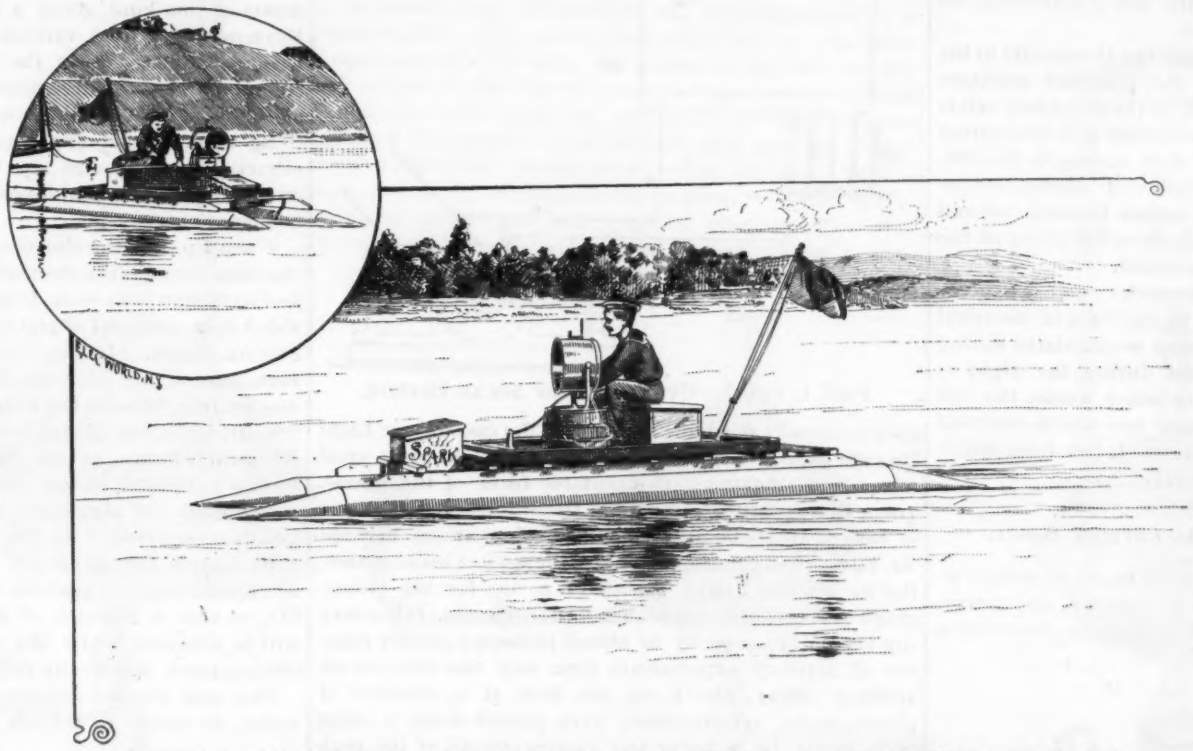
FIG. 13.

a given armature and magnetic field the electromotive forces rises with the speed of revolution of the armature. If the armature be turned very slowly, the magnetic field remaining at full strength, no appreciable current will be generated, because of the slow rate at which the lines of force are intersected. The same practical result would be accomplished if graduators, similar to those referred to, should be placed in the conductor *A*. That is, no appreciable current would be generated in conductor *B* owing to the gradual manner in which the lines of force would cut that conductor.

It is quite evident that the high resistance of the electro-magnetic graduators at each end of the circuit must reduce largely the current of the telegraph system; therefore it is necessary to increase the electromotive force of the battery to offset such loss of current strength. An increase of 10 to 20 per cent. in E. M. F. has been found in practice to about make up the loss. Furthermore, the gradual rise and fall of the current necessarily implies a narrowed limit to the rate of speed at which telegraph signals can be transmitted. It has been found practically that on wires of moderate length and for ordinary manual single or duplex telegraph work this limit is not reached.

A Novel Electrical Boat.

We illustrate on this page a very novel form of electrical boat recently built and run by Mr. Louis S. Clarke, of Pittsburgh, Pa. This craft was launched successfully on Conemaugh Lake, Pa., on July 4 of the present year, and has been in successful operation since. She was constructed on the catamaran principle in the belief that less resistance might thus be offered to the water, and that she might prove steadier than another boat of equal capacity of the ordinary type. The hulls are made of galvanized sheet-iron. They are 22 feet long and 14 inches in diameter. The two cylinders displace about 2,600 pounds of water. Between the hulls, which are placed 4½ feet apart, is a platform 6 by 7 feet. On this rests a box containing a storage battery equipment. This box serves as a seat. The battery comprises 26 cells of the "7 C" type, made by the Electrical Accumulator Company of New York. The cells weigh about 400 pounds. They are charged by the dynamo on Mr. Clarke's steam launch—an 8-light machine. The motor driven by these cells is placed in a box forward, and the screw shaft stands at an angle of about 8 degrees with the water line, and runs clear to the stern. The motor is of Mr. Clarke's design; it has a Gramme ring armature, and develops about six-tenths of a horse-power driving a 10-inch screw at about 450 revolutions per minute. The various motions for reversing, starting, stopping and regulating the speed are performed with the help of two small switches. The steering is done by means of a tiller in front of the seat. At night a search light is used, or the boat is lit up by 50 volt incandescent lamps of the Sawyer-Man make. This dainty craft, which has been dubbed the "Spark" by her owner, runs at a speed of 4 miles an hour.



A CATAMARAN DRIVEN BY STORAGE BATTERIES, LAKE CONEMAUGH, PA.

Incandescent Lamps Affected by Static Electricity.

BY JOHN J DEWEY.

Having noticed in THE ELECTRICAL WORLD of Sept. 8, 1888, the article entitled "Peculiar Behavior of Incandescent Lamps," and the invitation to others to report similar experience, I am induced to send an account of my experience last winter with the destructive effects of static electricity on incandescent lamps in my house here at Queechee, Vt.

The lamps had been in use but a short time when the carbon filaments in three out of six lamps on short wall brackets placed at the height of the picture molding around the room were found broken at one time, and two more a few days afterwards.

I was at first unable to find any satisfactory reason for their failure, but learned they had each time that day been brushed with a feather duster. I could not imagine how that would harm them in any way, and was on the point of giving it up as beyond my abilities to discover the cause, when, as I reached to take out one of the broken lamps, I thought I saw the carbon filament move or bend towards my hand, which, on further investigation, proved to be true, and that, in walking around the room a short time, I would become so charged with static electricity that my hand, when held near the lamp, would attract the filament, so that it would bend against the glass bulb.

I could then understand how the dusting had caused the trouble, as in the operation of dusting, the feathers would become highly charged with electricity, and in moving back and forth over the lamps, would strongly attract the filaments, bending them to the point of fracture. I was so confident I had discovered the cause of their breaking that I did not try the duster on the lamps, but its use was discarded and not a lamp has broken since.

If my theory is correct, it appears to me, in the case of the short life of a lamp near a calender in a Holyoke paper mill, that instead of the static electricity in the atmosphere disintergrating the filament, it was the attractive force of the static charge on the calender roll acting on the filament either by a continued strain which it could not resist but a definite time, or by bending and breaking it immediately when the conditions became favorable to produce a strong charge on the roll.

At this point in writing I have just received THE ELECTRICAL WORLD of Sept. 15, containing the article on "Effects of Static Discharges on Incandescent Lamps," which knocks my theory all into "pi;" but as my experience shows that there is something besides calenders and crossed belts that is dangerous to the life of incandescent lamps I send on what I have written for what it is worth.

The Electro-Chemical Action of the Earth.

BY R. W. D.

Since reading Mr. A. A. Knudson's article, "Another Curious Telephone Trouble," in THE ELECTRICAL WORLD for Sept. 8, 1888, I have made one or two experiments that deepen my conviction that the electro-chemical action of the earth is not wholly responsible for the trouble cited in the above article. I believe it will be acknowledged that it is highly improbable that the earth should act as a battery of more than one couple. Suppose that couple to be iron and copper, the E. M. F. of this is about one-half volt, perhaps more, certainly not more than one volt. Not knowing anything of the telephone line referred to, I will assume it to be 1,000 ohms, including instruments; this gives .001 ampère flowing in the circuit.

One of my experiments was to connect batteries of some 5 ohms resistance and 8 volts in series with the equal of an extra-territorial magneto bell. In ringing the bell I could detect no difference with the batteries in circuit and with the bell on short circuit. I fancy the magneto and bell have a resistance which can be assumed as 160 ohms without much error. This makes the current I used .05 ampère. Thus I had fifty times the current due to an "earth" cell, yet could detect no difference in the ringing of the bell, whether the current was on or off. From this simple test it seems to me that the true cause of the difficulty has not been found, yet I do not wish to say the gentleman is wrong, for there may have been other data which I do not know. Although I have made this friendly criticism I can offer no solution to the problem, unless there is some high potential circuit leaking into the telephone line or some earth current present not due to chemical action, and I hope Mr. Knudson will, if he thinks my point well taken, give the trouble another examination and report.

In connection with this I made the following experiment: A water battery of 50 cells (some 45 volts) was put in circuit with the above magnets. This caused the bell to work with less effect even with an increased speed of the magneto armature, but on dividing the battery into two series of twenty-five each and opposing them, thus having no E. M. F. but the same resistance as before, there was no louder ringing of the bell, the same speed of armature being maintained. This seems to show that a magneto's E. M. F. is high. Can any one tell me what it is?

Impossible Forms of Phonograph.

BY R. M. HUNTER, M. E.

I was much interested in the article under the title "Some Possible Forms of Phonograph," by Oberlin Smith, Esq., published in THE ELECTRICAL WORLD of Sept. 8.

I notice that in the last two paragraphs of the article he describes a possible form of an electrical phonograph, in which a stylus would be required to act upon a carbon medium, to be used subsequently with a receiver to vary the electrical impulses. He states that he has not worked this out as yet. I would call his attention to this paper, of Nov. 26, 1887, in which he will find a full description, with illustrations of my improved phonograph, which works on precisely the same principle which he refers to.

In regard to the idea of employing a cord of small magnets such as he proposes, I believe that he would experience insurmountable difficulties, not only from the impossibility of equalizing the composition of his cord, but also the impossibility of producing in it, with the same current, magnetism of equal strength. Furthermore, after rolling the cord upon a cylinder, subsequent to its being magnetized, the magnetic condition of the magnetic particles would be so much changed that their magnetic intensities and poles would be materially modified, so much so that I doubt whether he could reproduce anything approaching the order of currents originally transmitted through the phonograph.

His first proposed phonograph, illustrated in Figs. 1, 2 and 3, might be more or less practical, but the mechanism employed would be objectionable as a phonograph, which not only requires auxiliary devices, such as lamps, whose temperature is not only difficult to maintain but requires a great deal of attention. In this form considerable difficulty w uld no doubt arise with the stylus point in the transmitter.

His proposal to use a hard steel wire in the constructions shown in Figs. 4 and 5 in place of the cord *C*, I fail to see could result in obtaining what he desires, for it would be difficult to regulate the poles in a continuous wire, and particularly so when they must be infinitesimally close together. His suggestions are certainly in most part original and are highly interesting, and give me consid r-able pleasure in their perusal.

The Influence of Electricity on the Human Organism.

Dr. Schliep, who is well-known as a specialist on the Continent, is just now, reports the London *Electrical Review*, delivering a series of most interesting lectures on his researches as to the influence of atmospheric electricity on the human organism, on its functions, its state of health or disease. It is well known that the electrical state of the atmosphere has a certain influence on the phenomena of life, but the action of positive electricity and of negative electricity on these phenomena has not yet been determined. Now, according to Dr. Schliep, in supposing the earth charged negatively, an atmosphere charged with positive electricity would act as a stimulant on the human organism, while that with a negative charge would have an enervating effect. Positive atmospheric electricity would favor organic exchanges, oxidation, the circulation, the secretions. But in order that its influence might be salutary, it would be necessary that it should be in a certain affinity with the nervous excitability of the individual. An excessive positive tension would produce a state of insomnia, neuralgia, megrims, and even of inflammatory affections. Negative atmospheric electricity would retard the exchanges and would superinduce fatigue, the interruption of the secretions, congestion, apoplexy, etc. As far as plants are concerned, on the contrary, their mutation would be favored by a negative atmospheric organization. The vegetable germs and microbes floating in the air would tend to develop when the atmospheric electricity was negative, and a year in which the days in which this condition was realized predominated, would be favorable to the development of epidemic diseases. It is well known that on stormy days milk goes sour, organic substances decompose, and bad odors are more noticeable than in normal weather. These phenomena are explainable by the influence of negative atmospheric electricity. With a positive electricity, light, heat and humidity could only have these effects in a modified degree. In conclusion, Dr. Schliep believes that atmospheric electricity has an important effect on the action of the organizm and on the therapeutic properties of the air.

A Possible Application of the Phonograph.

BY R. J. HEWETT.

The phonograph seems to be a promising auxiliary to the Wheatstone automatic system. The phonograph can be substituted for the ink recorder, and the signals read off by a Morse operator at his leisure at lower speed. The phonograph motor would require two different speeds—a high speed for receiving the automatic telegraph signals and a slow speed for reproducing to the Morse operator. The slow speed should still further be variable within a smaller range, so as to suit the ability of the receiver. Thus the automatic and manual service would be combined, the automatic being used for transmission, while the manual service, aided by the phonograph, can be employed for receiving.

Growing by Electric Light.—The Fairfield, Me., *Journal* mentions the case of a young tree in the town which standing directly under the rays of an electric light is growing much more quickly than its fellows.

Utilizing Solar Radiant Energy.

As is well known, experiments have been carried on to utilize the radiant energy of the sun in concentrating the rays of light and heat upon a boiler, the steam generated in which is caused to perform mechanical work in a steam engine. The action of light on the selenium cell, by which current is produced, has also been proposed as a method of utilizing solar energy, but thus far has not been carried out in practice. Recently, however, Mr. Edward Weston has attacked the problem in another way, and has sought to overcome the principal objection to the older methods by devising a plan in which the discontinuity of the sun's rays has within limits no appreciable effect upon the working of the aparatus. As described in a recent patent, Mr. Weston displays a mirror or lens *F*, Fig. 1, which concentrates the sun's rays upon the thermopile *A*, the surface of which is covered with lamp-black or other heat absorbing material, at shown as *G*, in Fig, 2.

The thermopile *A* is connected by wires *a a* in circuit with the electrodes of secondary cell *H*, and the electrodes are also connected by wires *b b* with electro-motor *K*. Interposed in one of the wires *b* is an ordinary circuit-closer *c*, whereby circuit can be established or broken between the secondary cell *H* and motor *K*.

At *d* is an electro-magnet having its coil in circuit with one of the wires *a*. The armature *e* of said magnet is polarized and is pivoted at *f*, and connected to one terminal of the magnet coil, so that the circuit proceeds from the coil through the armature to a stop *g*, with which the armature makes contact when attached by the electro magnet, and thence to the secondary cell *H*. A spiral spring *h*, attached to the pivoted armature, aids in retracting the same from the pole of the magnet.

When the current proceeds from the thermopile to the secondary cell, the magnet and the polarized armature mutually attract, and the circuit to the secondary cell is maintained. When, however, the strength of the current in the cell becomes greater than that passing to the cell, then the magnet-poles are reversed, and magnet and armature mutually repel, and the circuit between cell and thermopile is broken. In this way short-circuiting of the cell through the thermopile is prevented.

The object of the storage or secondary cell is to accumulate the solar radiant energy in the form of electrical energy, so that, for example, energy accumulated during hours of sunshine may be utilized during the night or periods of cloudy weather; or, in other words, the cell here acts substantially as a reservoir into which electrical energy may be intermittently delivered, but from which it may be taken as a constant supply.

The Rechniewski Alternate Current Motor.

Alternate current motors have now begun to attract attention in England as well as in this country, and various types been suggested or built. We illustrate herewith a

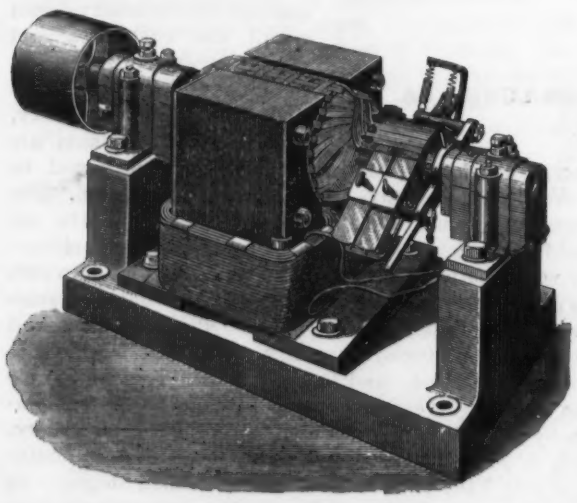


FIG. 1.—THE RECHNIEWSKI ALTERNATING CURRENT MOTOR.

motor designed by M. W. C. Rechniewski to work with alternating currents, and constructed by Messrs. Goolden & Co., at their Halifax works, England. The motor, Fig. 1, does not differ from the ordinary continuous current type, except that the field is of laminated iron. The armature is of the drum type, with Paccinotti teeth. For the sake of economy in the manufacture both the armature and field-magnet cores are stamped out of one sheet. Fig. 2 is a section of the iron cores.

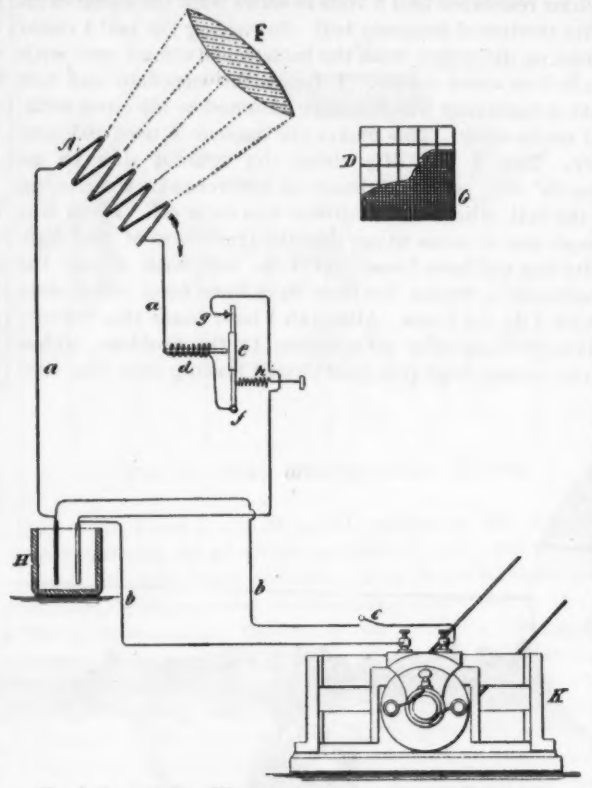
The following figures relating to a machine of fifteen horse-power have been furnished to the *London Electrician:*

Volts at terminals, 115.
Current, 100 ampères.
Revolutions per minute, 1,400.
Diameter of armature, 8 in.
Peripheral velocity in feet per minute, 2,800.
Weight of iron in field, 440 lbs.
Weight of iron in armature, 108 lbs.
Section of iron in field, 42.5 sq. in.
Section of iron in armature, 33.5 sq. in.
Induction in armature, 3,700,000 lines.
This motor is not, of course, self-regulating.

Uses of the Phonograph.

A London correspondent of the New York *Times* writes as follows:

A distinguished officer said to me, after we had inspected Edison's phonograph on Wednesday night at the Press Club by favor of Col. Gouraud, "I wonder can that be adapted to naval and military use?" Subsequent conversation with him developed these ideas: There is hardly a campaign of which we have a complete record; there is hardly an accident at sea of which we have ever heard, or that did not give rise to the question of the exact wording and precise emphasis on the wording of an order. The most conspicuous instance in modern times of a misunderstanding was perhaps the case of the charge at Balaklava, but the ceaseless flow of battle papers in the American magazines



FIGS. 1, AND 2.—UTILIZATION OF SOLAR ENERGY.

goes to show that what happened in the case of our Light Brigade happened in subs tance pretty often in your great war. Now, if there were a portable form of the phonograph there could be a record of the orders given, whether in case of an action ashore on an accident afloat. Perhaps Mr. Edison will condescend to give the subject his attention. But meanwhile I have "spotted" a use for the phonograph that probably has occurred to no one else. It has been my lot in days gone by to attend perhaps a greater number of artillery experiments than any one else not an artillery officer, and I can see how if a number of phonographs, synchronized, were placed along a range there would be a better and clearer record of the path of a shot or shell than there is at present where the use of screens inevitably causes some deflection and some loss of energy, however light. But in applying the phonograph to military and naval purposes it does seem to be necessary that there should be found some more durable, even if less sensitive, material than the wax cylinder as the receiver of the vibrations. That such a material exists can hardly be doubted; but it may interest Mr. Edison to know that already some of the smartest military minds in England are considering his invention with a view of its adoption for, or adaptation to, military purposes. I do not feel at liberty to say more on the matter at present.

Electric Refining of Sugar.

Sugar merchants and brokers all over the country are in a flurry, reports the Philadelphia *Record*, at the announcement recently made to the effect that the much-mooted process of refining raw sugar by aid of electricity had been brought to a consummation, and that by the middle of next month a refinery using this process exclusively would be in operation. It is said that a party of English and American capitalists, representing at least $15,000,000, is now prepared to erect electric refineries in all the principal cities on both continents if the process should be proved to be successful by Oct. 10. If the scheme is all right it will cause a revolution in sugar refining that will mark an important era in the history of that article of commerce.

This system is, however, the same that has been in process of completion for the last ten or fifteen years, and it is the same that has so repeatedly failed in accomplishing its purpose that the faith of those who at one time believed in its ultimate success was so frequently shocked as to create a prejudice against it and eventually secure the condemnation and arouse the incredulity of its erstwhile advocates. Of late years an almost universal opinion declaring the system to be impracticable has been in existence, and nothing short of a thorough exposition of the system and its principles will restore the faith of men in the sugar trade. This, it is claimed, has been given; but it was satisfactory only to a degree. In a refinery in Brooklyn a few days ago a quantity of raw sugar was refined in the presence of a party of gentlemen interested in the process. Thirteen barrels of the raw material were refined at the recent test. The cane was put into a receiver, from which it passed through two secret rooms, containing the machinery before being run into barrels in a refined state. What the machinery is no one, apparently, except the inventor, seems to know. The raw cane goes into the receiver, and once it leaves that simple piece of mechanism it is not seen again until it finds its way out through a chute at the further end of the two mysterious machinery rooms. During the time the machinery was in operation (25 minutes) the refined article was turned out at the rate of one barrel for every two minutes. The process of refining is claimed to be perfectly dry, and it certainly must be, for when it came through it was dryer than the raw cane and the crystals were absolutely perfect.

Electrolysis by Means of the Alternating Current.

BY DR. P. H. VANDER WEYDE.

Under this head there is mentioned on page 57 of THE ELECTRICAL WORLD of Aug. 4, that Mr. Neyreneuf describes in the *Journal de Physique* results of the action of alternate currents upon aluminum electrodes submerged in diluted acid, which are, that pure hydrogen is evolved at both electrodes. These results are stated to be of a remarkable character, while it is also said that we are not told what becomes of the oxygen.

Several years ago I went through a series of experiments of this kind, going a great deal further than M. Neyreneuf. I used various metals as electrodes, and various liquids, but as the results I obtained were the common, natural consequences of well-known laws of electrolysis, I did not think it worth while to publish anything about it, not expecting that there would be any electrician who would not know what becomes of the oxygen in the case mentioned, nor what to expect in other combinations.

When I passed the alternate current of a hand magneto machine through the electrodes of a voltameter, oxygen and hydrogen both were developed at each electrode, provided they consisted of platinum or any other non-oxidizable conductor. If they consisted of zinc, iron, copper, aluminum or any other oxidizable metal, only hydrogen was set free, because the nascent oxygen being formed at the surface of the electrode will manifest the irresistible chemical affinity of an element in the nascent state toward oxidizable metals, and will combine with the zinc, iron, copper and aluminum to form the oxides of these metals respectively. In this way the current will gradually destroy the electrodes. If the latter consist of carbon the nascent oxygen will attack even this and evolve CO_2, so that a mixture of hydrogen and carbonic acid will be obtained, while the carbon will become porous, disintegrated, and finally falls apart.

Zinc and iron are capable of decomposing acidulated water; in order to furnish the oxygen they need to

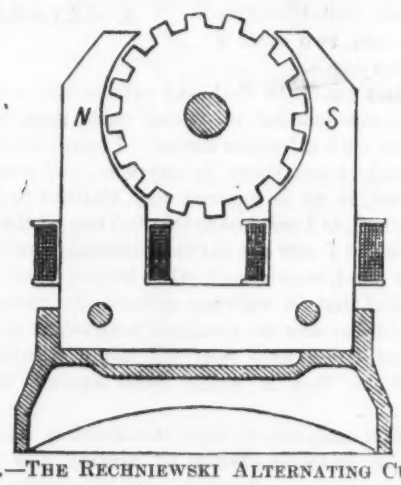


FIG. 2.—THE RECHNIEWSKI ALTERNATING CURRENT MOTOR.

be oxidized; but neither aluminum nor carbon can do this; they will even resist the strongest acids. Aluminum, however, can be oxidized by caustic potash or soda, or by combustion, and also by nascent oxygen, developed on its surface by an electric current. Carbon resists the caustic alkalies and can only be oxidized by combustion and by the nascent oxygen developed on its surface by the electric current when used as an electrode.

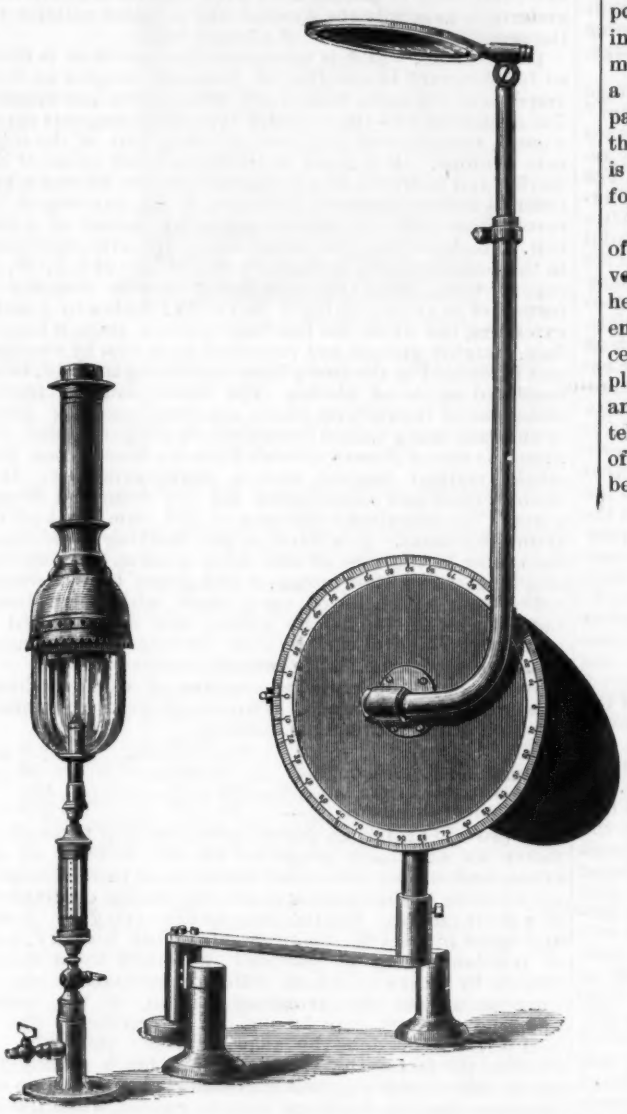
By the direct current only one carbon electrode will be destroyed, namely, that at which the oxygen is developed; by the alternate current, however, both electrodes are doomed.

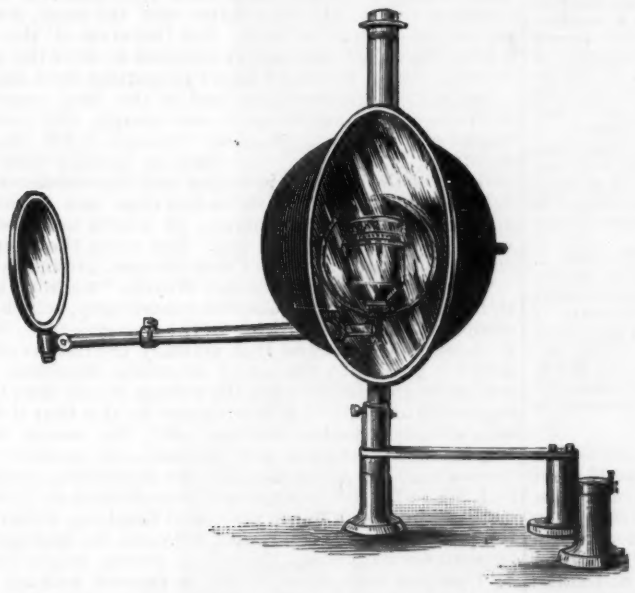
When two different metals are used for electrodes and immersed in pure water, the metal which is the easiest acted upon by the current, aided by the electrolysis of the water, will undergo the greatest change, and in doing so will consume some of that one current which induces the change, thus destroying the electrical equilibrium of the two currents. This will give prominence to one of the two currents, and will give rise to the deflection of the galvanometer, which must necessarily be in the opposite direction to that which the easily oxidizable metal

would evolve if it originated the current by its own chemical change, instead of receiving the current—in short, as if it were active, instead of being passive. If now an acid is added to the pure water the two different metals will act like a galvanic couple, and another current will be developed, contrary to the previously prevailing alternate current, which must necessarily diminish its energy.

This is the way by which I accounted to my own satisfaction for the "much more extraordinary results" so-called in the article under consideration, namely, that when one of the electrodes was aluminum, the other mercury, and the liquid distilled water, "*the current passes in one direction only*, and the arrangement forms what the author calls an electric valve." It also explains why "the addition of some drops of acid to the distilled water notably *diminishes* the current."

Continuing my experiments further, I found that when the electrodes offered the customary large surface of strips of platinum to the liquid in the voltameter, the two currents neutralized one another and no decomposition of the water took place; but when the surface was small, such as is the case when using pieces of thin platinum wire, say 1 or 2 inches long, hydrogen and oxygen both were developed at each electrode, which, when consisting of an oxidizable metal, combined with the oxygen and set only the hydrogen free, as stated above.





FIGS. 1, 2 AND 3.—THE NEW HARCOURT PHOTOMETER.

It was well known long ago that to obtain electrolytic action the revolving armature coils of magneto machines must consist of heavy wire, for the same reason that dynamos now made for electro-plating are provided with very heavy wire, If the wire of a magneto machine is fine, I found that it is necessary to reduce the surface of the platinum electrode still more, in order to obtain the decomposition of water. This agrees perfectly with what has been found to be the case when attempts were made to decompose water with static electricity, which is impossible when using the ordinary electrodes, either strip or wire; but when fine platinum wire was melted in glass tubes ground off at the ends, so as to expose to the liquid only the small cross section of the wire, it is possible to obtain hydrogen and oxygen bubbles at such electrodes by means of static electricity, the nature of which is similar to that produced by very finely wound armatures, both carrying a high electromotive force, and low quantity or volume of current.

When electrodes of different metals were used as current generators in a voltameter by submerging them in such liquids as exerted chemical action upon them, observations were made which sometimes puzzled and surprised me. For instance, when one of the electrodes was aluminum, it would deflect the galvanometer by intermittent impulses bringing it to rest, and then suddenly reverse its polarity and deflect the needle to the other side. Such incidents were at last accounted for by chemical changes taking place in the liquids used during the experiments.

Mr. Vernon Harcourt's New Photometer.

The holophotometer has been designed in order to get rid of two difficulties connected with other methods of attaining the same object, viz., to measure the light emitted in every direction by any luminous source. These difficulties are: 1. The movement of the light to be measured or of the standard lamp, neither of which is desirable. 2. The errors caused in the measurement of lamps provided with reflecting fittings, by the assumption that the flame is the zero point from which measurements should be made, whereas, strictly speaking, the principal focus formed by the reflector should be taken as the zero point. Inasmuch, then, as this focus may be several inches away from the flame, and as the length of bar usually employed is 60 inches, it is evident that serious errors may be introduced by the difference between the real and the assumed zero point. To establish the existence of such an error, and to eliminate it, two things are necessary, viz., that readings should be taken with bars of various lengths; and that the length of the bar should be very great compared with that between the real source of light and the focus formed by the reflector. Both these points are secured by the use of the holophotometer. The instrument is mounted upon a table capable of being moved nearer to or further from a fixed table containing a graduated bar with movable disc (say of the Latheny pattern), and having a standard lamp fixed at the zero of the bar. The lamp to be be measured is mounted upon or is in rigid connection with the movable table, and is therefore not moved during a series of readings.

The holophotometer, as seen in the illustrations, consists of an axis working friction-tight in a collar supported by a vertical pillar. The axis is accurately fixed at the same height, and in a line with the centre of the disc. At the end nearest to the disc is placed a large mirror with its centre concentric with the axis, but so arranged that the plane of the mirror may be inclined and clamped at any angle to the axis. At the other end of the axis is fixed a telescopic arm carrying a smaller mirror, which is capable of being turned into any required position. The arm being rigidly fixed to the rotating axis of the instrument, to which is also attached the larger mirror, it follows that the rotatory motions of the mirrors about the axis are identical. The angles of rotation are measured by the indications upon a divided circle attached to the moving axis, which are shown by a pointer fixed to the upright support.

The mirrors are adjusted in such a way that the light from the lamp to be measured falls upon the smaller mirror, thence is reflected on to the larger one, and, finally, along the axial line of the photometer disc. As both mirrors rotate together, it follows that if a horizontal beam is reflected correctly, all other beams will find their way along the axis of the photometer. If, therefore, the arm carrying the small mirror be moved through various angles, it will receive the light emitted from the lamp at those angles, and the light will at every angle be transmitted along the axis of the photometer. The divided circle is made large enough to serve as a complete screen of all direct light; and only the light falling on the small mirror can find its way to the disc. In order that absolute, as well as comparative, tests may be carried out, only one additional measurement need be made. The direct horizontal light is measured without the interposition of the holophotometer (which is mounted so as to be easily moved out of the direct line); then the mirrors are interposed, and a new measurement made. The additional path traveled by the light is allowed for in calculation, and thus the absorption of the mirrors is found once for all for the particular character of light under measurement. It is only necessary afterward to multiply subsequent values by this coefficient of absorption in order to obtain absolute measurements at various angles.

The employment of mirrors in photometry has sometimes led to serious errors; but it will be seen by the foregoing description that inasmuch as the relative angle of the mirrors is never changed, and as their absorption is easily calculated and allowed for, the only objections to their use have been guarded against and avoided.

In order to eliminate a second source of error mentioned above, viz., that arising from the formation of a principal focus, it is only necessary to take a series of readings with the table in one position, and then move it to a greater distance and take another series. If a focus is formed at a sufficient distance to produce an appreciable error, it will clearly appear in the difference between the readings at the two distances, and then it is only necessary to wheel the table to such a distance that the discrepancy is inappreciable. In other words, this is equivalent to using a bar of sufficient length to make it practically infinite compared with the distance between the focus and the real source of light.

The instrument has been designed specially for use in lighthouse work, where it becomes of the highest importance to measure accurately the total light given by any lamp, and not only that emitted in any one direction, which may or may not be the maximum.

Preliminary experiments made with the instrument by Mr. Stepney Rawson, at the works of the Woodhouse & Rawson Electric Manufacturing Company, have shown what a valuable instrument it is for the determination of the commercial value of various lamps, as well as for assisting in the many difficult problems of the diffusion and reflection of light. The absorption of the two mirrors used is, as already mentioned, stated to be only 1.8 per cent.; but a series of experiments is to be made upon this point.

We show here three views of the instrument:

Fig. 1, as shown from behind, showing the divided scale; Fig. 2, looking from the photometer disc, showing how the horizontal light from the lamp is transmitted to the disc; and Fig. 3, looking from the photometer dise, showing how the vertical light would be transmitted to the disc. The instrument is made by the Woodhouse & Rawson Electrical Supply Co., of London.

Statistics of Injury by Lightning.

In his work on "The Thunderstorm" ("De la Foudre: de ses Formes et de ses Effets") M. Sestier has collected the following statistics relating to this subject:

Only a minority of lightning accidents are fatal; in 601 cases there were only 250 deaths. Fatal accidents are more frequent in men than in women; of 307 men struck by lightning, 165 were killed, while of 137 women only 51 perished. In the vast majority of fatal cases (340 out of 354) death was instantaneous. The danger is greatest in buildings and places (churches, schools, &c.) where crowds of people are gathered together. The part most often struck is the head, then the chest and limbs. In cases in which the head is struck, the mortality is double what it is when only the trunk or limbs are injured. Among the results of lightning-stroke are the following, according to the authority quoted above: Loss of consciousness, lasting a few minutes to seven days; paralysis, lasting from half an hour to four months; deafness, lasting from a few seconds to several months; blindness, lasting from three days to seven months; lastly, a state of apparent death lasting from a few minutes to six hours after the accident.

A Defense of the Brown Experiments.

BY HAROLD P. BROWN.

After my demonstration on July 30, a gentleman, who I have since been informed was Dr. P. H. Vander Weyde, came forward and asked a great number of questions, which I answered carefully, giving him several diagrams of connections. From his paper, which was published in THE ELECTRICAL WORLD of Sept. 8, I see that he entirely failed to understand me and has apparently not heard of the continuation of the experiments under the auspices of Dr. Cyrus Edson and Dr. C. F. Roberts, of the Board of Health, on Aug. 3. As the official report of these experiments has not been published by any of the electrical papers I here give it:

At the School of Mines of Columbia College, this morning at eleven o'clock, experiments were undertaken at the request of Harold P. Brown, electrical engineer, to determine the danger of alternating currents, by Dr. Cyrus Edson and Dr. Charles F. Roberts, of the New York Board of Health. The first dog operated upon was a mongrel dog weighing 61 pounds, strong and in good condition. His height was 24 inches; length, from tip of nose to base of tail, 42 inches, and resistance, from the right front leg to the left hind leg, 14,000 ohms. Connection was made by binding a piece of cotton waste saturated with water round the leg with No. 20 bare copper wire. The dog was placed in the cage and the alternating current applied by Dr. Roberts at 272 16 volts for five seconds; number of alternations, 288 per second. The dog was silent and motionless during the continuance of the current. He gave a few spasmodic gasps 31 seconds after current was first applied, and heart ceased beating 90 seconds after current was applied. The dog was immediately dissected by Dr. Roberts and Dr. Peterson, and section of sciatic and pneumogastric nerves, muscular fibres of diaphragm and lungs placed under a microscope, and no changes in structure were observed. The second dog was a full-blooded Newfoundland, strong and in good condition, weighed 91 pounds; length from tip of nose to base of tail, 48 inches height, 25 inches; resistance, 8,000 ohms. Connection was made in the same manner as above. Alternating current applied by Dr. Roberts at 340.5 volts electromotive force for five seconds. The dog was silent and motionless during continuance of current; howled and gasped for eight seconds, after circuit was opened, but in the opinion of physicians present this was purely mechanical action, as the dog was unconscious from the instant the current first reached him. Heart stopped beating in two minutes and fifty seconds after current was first applied. The third dog was a half breed setter and Newfoundland, weighing 53 pounds, 42 inches long from tip of nose to base of tail, and 24 inches high. Resistance, 30,000 ohms. Connections were made in the same way as before. Dr. Roberts applied the alternating current at 220 volts for five seconds; the result was not fatal at four minutes afterwards. Mr. Porter, superintendent of machinery of Columbia College, then suggested that as the dog was rigid and motionless during the continuance of the shock, it would be impossible for a man in the same conditions to utter a sound or to break the contact in five seconds. Dr. Edson then determined to administer the current at same number of volts for 30 seconds on this account and on account of the high resistance of this subject. This was done, and during the period of the 30 seconds the voltage rose to 234 volts. The dog died instantly without sound or struggle. The resistance after death was found to be 2,800 ohms. All of the physicians present expressed the opinion that a dog had a higher vitality than a man, and that, therefore, a current which killed a dog would be fatal to a man under the same conditions. It was their opinion that all of these deaths were painless, as the nerves were probably destroyed in less time than that required to transmit the impression to the brain of the subject.

Dr. Edson invited Elihu Thomson, of Boston, and Dr. Otto A. Moses to be present with measuring instruments to check up the voltage, etc., but neither of these gentlemen put in an appearance or responded. Approved by Dr. Cyrus Edson, of the Board of Health; Dr. Chas. F. Roberts, Assistant Professor of Physiology, Bellevue Hospital Medical College; Dr. Frederick Peterson, Dr. Frank H. Ingram, Dr. H. A. Haubold, Mr. John Murray Mitchell, Professors C. E. Colby and E. H. Laudy, of Columbia College; Capt. E. L. Zalinski, U. S. A., and Dr. Schuyler S. Wheeler, electrician of the Board of Electrical Control.

Dr. V., whose article states that he is an anxious seeker after scientific truth, will, of course, pardon me if I set him right on matters wherein he is very greatly mistaken. He must first appreciate that it has long been known that continuous currents of high tension would kill, so it was not necessary for me to prove it. But I had stated that if a relay should be so arranged as to take the extra current, which he so graphically compares to "water-hammer" in pipes, the continuous current of 1,000 volts and more would do no damage. He admits that I succeeded in proving this, but takes me to task for doing so. The same experiment further proves that apparatus for shutting down the current the instant a ground connection is made, even though it be made through a living being, would prevent fatal results. Such apparatus, therefore, would very much diminish the dangers of arc lighting.

But the alternating current employés had publicly declared that their current was "perfectly safe" and "absolutely harmless" at 1,000 to 1,200 volts, and it was therefore necessary that I should prove that the alternating current would instantly destroy life at less than one-fifth this pressure. This I attempted to do, but the interference of the S. P. C. A. left the matter unproved until the following Friday. Other experiments since made at the Edison laboratory by Mr. A. E. Kennelly, confirm my results, and only those who are financially interested in alternating current systems or in "new and very peculiar" designs of converters can doubt such results.

Evidently Dr. Vander Weyde has never heard of the Cardew voltmeter, as he takes exception to its principle, and says that it must be an ammeter; will he tell me wherein voltmeters of the ordinary type differ from ammeters except in their resistance and calibration? If Dr. Vander Weyde will write to Professor Forbes or to any other prominent electrician who has time to keep posted on current inventions, he will find that what he calls a "pretended" voltmeter is in good and regular standing as a correct and reliable instrument, and that the "indications of rise in temperature" can be and are used for measurements of both current and E. M. F. See page 467 of the third edition of S. P. Thompson's "Dynamo-Electric Machinery." The voltmeter in question was loaned to me on July 30 by Mr. Thomas A. Edison, and Mr. A. E. Kennelly, his chief electrician, who calibrated it immediately before my use of it, will verify my measurements. In fact, Mr. Kennelly himself made all observations of the E. M. F. on the day in question, and he will also bear witness that Dr. Vander Weyde is *entirely wrong* in saying that the voltmeter and ammeter were in series. How the Doctor made such a mistake I cannot imagine. The ammeter was in series with the subject when the continuous current was used, and the ordinary type of potential indicator was then connected in parallel, as shown in my diagrams. But when the alternating current was used, the Cardew voltmeter was in parallel with the subject, and, as we could obtain no ammeter for this current, we measured the resistance of the subject and calculated the current.

Dr. Vander Weyde says: "I must also not omit here to state that if Mr. Brown had known the proper quarters where to apply for apparatus to determine properly the voltage and ampères of alternate currents, he could have been provided, and his labors in that direction might have had some value." I not only in a published letter asked that such apparatus should be brought, but in my invitations I particularly requested the leading representatives of the alternating current companies to bring such instruments. Before my experiments I asked them to appoint a committee of three to come forward and check up my measurements; no one responded but Mr. Smith, who brought nothing but a complaint that his invitation, which was one of the first I mailed four days previous, had not reached him sooner. I gave every one a fair chance to prove whether or not my measurements were correct, and it is therefore very unfair and unscientific for Dr. V. to question my results at this late date. Had I known him to be connected with the alternating current interests, I should have invited him to bring his instruments. I will here say to him that experiments with the same current are now in progress, and if he will agree to publish results in the same papers in which his article appeared, and will bring standardized instruments for measuring the current and E. M. F., and allow same to be afterwards calibrated by the authorities in charge, I will see that he is invited to participate.

What the Doctor says concerning the fact that "Voltage alone is no criterion in regard to the danger of a current" is correct, but he must not forget that with a constant potential, the resistance of a living subject is rapidly reduced and the current correspondingly increased. For example the resistance of the third dog killed by the alternating current on Aug. 3 was at first 30,000 ohms; after death it had fallen to 2,800 ohms; the voltage that killed it was 234. From this Dr. V. may calculate the current for himself, and as Dr. Schuyler S. Wheeler made the measurements in this case, he must not talk of the "worthlessness" of the observations. But to return to his article, may I ask him to explain how he came to make such an assertion as this: "According to the statement of the engineer, the engine driving the 125 ampère dynamo requires 36 h. p., that of the alternate dynamo 36 h. p.; together, 72 h. p., which at 746 watts per h. p. gives 54,712 watts?" There was a time when Dr. V.'s method of estimating power required by a dynamo was correct, and that was when any translating devices that were not in use were replaced by equivalent dead resistance, so that the electrical output of the dynamo was the same, irrespective of the current utilized. But this state of the science is long since past, and power required to drive the modern dynamo varies in almost direct proportion with the load.

In the case criticised, the load in the final experiment with the continuous current was simply the power required to maintain 1,000 volts through 2,100 ohms, the resistance of the dog at that time, in parallel with the resistance of the pressure indicator and the resistance of the field magnets. This would be less than one horse-power appearing in electrical energy, of which but about 476 watts passed through the dog. But when the alternating current was used a third of this amount proved fatal.

"After all," says Dr. Vander Weyde, "we must not lose sight of the main object of this controversy, which is the comparative danger lurking in the two systems. When it is found by experience that actually the danger of being killed is greater by the use of alternate currents, it does not make any difference if the voltage which does the killing is 300 or 1,300." If it is meant by this that if 300 will kill, we might just as well use 1,300, the doctor is mistaken, since the higher the pressure, the greater will be the leakage to ground through the insulation, and at 1,000 to 1,300 volts, this leakage will be sufficient to kill a person standing on a damp place and touching either one of the primary wires; whereas at 300 volts, the leakage would be scarcely dangerous, though a person might be killed by touching *both* wires. I am at present making experiments which tend to show that arc light dynamos may be operated up to at least 2,000 volts without any danger, and shall in due time publish results. But until my previous results, printed in THE ELECTRICAL WORLD of Aug. 11, have been disproved by practical experiments, it must not be forgotten that I have proved that 1,420 volts continuous current may be made harmless, while 170 volts alternating applied to an exactly similar subject, kills. If in spite of this the arc lighting companies prefer to put themselves by resolution upon a par with the alternating current in regard to danger, so much the worse for them.

Mr. Gutmann also criticises me, and says that the best place for the converter is indoors; true, it is the best place for the converter itself, but the best thing for the safety of the persons in the house is to keep the primary current out. The danger is not so much to a person touching the secondary, as it is to a person touching either primary wire when on a damp place; and the placing of a grounded piece of copper foil around the primary coil in the converter of course diminishes the insulation and increases the leakage. Several cases to prove this will, I believe, soon be published. Mr. Gutman seems to be a fairminded man and says that I ought to ask permission to experiment with the apparatus of a regularly equipped alternating current station, and wants to have certain experiments that he suggests tried. If he will give permission to use current from his station in this city, such experiments will be made at once by competent authorities, and I hereby ask such permission.

I understand that an official list of the persons killed and crippled by electric lighting is being made; in its present incomplete state it shows that the number of victims of the alternating current in this country is already far in excess of its proper proportion when compared with arc lighting, and this result is obtained from new plants with presumably good insulation. It is by no means "an idle occupation," as Dr. Vander Weyde says, to bring these facts before the public, as human life is too valuable to be trifled with. Governor Cornell's letter, proposing to prohibit high tension currents by law, is exactly what I predicted in my article in the *Post*, and it is the outcome of the persistent neglect of the electric lighting companies to take all possible means to secure public safety.

Each additional homocide caused by poor insulation, inadequate testing for grounds or too high pressure, will be an argument in favor of legislative prohibition instead of wise legislative regulation, which not even an alternating current "trust" of twenty millions can overcome.

On the Application of Electricity to the Working of a 20-Ton Traveling Crane.*

BY W. ANDERSON, M. INST. C. E.

One of the traveling cranes in the foundry of the Erith Iron Works was originally constructed to be worked by hand, but preparations have been made for the application of wire-rope driving at some future time.

The crane is 39 feet 6 inches span, and consists of a pair of wrought-iron girders resting on end carriages, each running on two wheels on an elevated line of rails. The gearing for hoisting for longitudinal and for cross traverse is secured on to the tops of the main girders; the hoisting chain passes from the barrel, which is at one end of the crane, over a pulley at the other, then back to pulleys in the cross traversing carriage which runs between the main girders, thence through a falling block, and finally to an anchorage under the barrel at the extreme end of the main girders. By this arrangement the crane occupies a moderate height, and the hook can come within 3 feet of each wall.

The inconveniences and wear attending the use of rope driving gear or of a long main driving shaft, and the dirt and special attention required by a steam crane, induced the writer to try whether electricity might not be used with advantage. Messrs. Elwell-Parker, of Wolverhampton, were communicated with, and these gentlemen undertook to supply the dynamo and a motor suitable for the peculiar requirements of a heavy crane.

The dynamo, which is considerably larger than is needed for the crane in question, is arranged to give up to 80 ampères at 120 volts, with 1,200 revolutions per minute. The armature is of the cylinder type, field-magnets shunt wound, resistance of armature .07 ohm, and of the magnets 75 ohms. It is fixed in the main boiler house of the works, and is driven by a horizontal engine, having a cylinder 9½ inches diameter, 12 inches stroke, running at 180 revolutions with 50 pounds steam, by means of a link belt. The leads from the boiler house up to the conductor in the foundry, for a distance of 60 feet, are of 6 B. W. G. copper wire, while the conductor in the foundry is formed of an angle iron bar 2 inches by 2 inches by ¼ inch, extending the whole 350 feet length of the shop; it has one face, roughly ground and protected from rust by vaseline, and is secured to the iron pillars supporting the roof, being insulated by wood blocks. The return current travels along one of the rails on which the crane runs, the joints of the rails being united electrically by copper staples. The motor is one of Messrs. Elwell-Parker's latest types, with single vertical magnet and a drum armature. It is shunt wound and constructed for 100 volts and 50 ampères. The armature resistance is .056 ohm; that of the shunt 49.2 ohms. It is fixed on the working platform of the crane, beside one of the main girders. Its driving spindle carries a steel pinion, which gears into a double helical spur wheel, keyed on a shaft which runs longitudinally on the top of the girder, and is connected by nests of three bevel wheels, with friction clutch connections to the three shafts which command the several movements of the crane, the means of using the hand-power being still retained. Two sets of speed are arranged for each of the movements, namely:

	Slow per min.	Fast per min.
Hoisting	3.4 feet.	10 feet.
Cross traverse	25 "	105 "
Longitudinal traverse	78 "	213 "

To provide against an undue current passing through the motor an automatic magnetic cut-out is fixed on the crane, and as an additional security a fusible wire is placed close to the dynamo to provide for the contingency of a short circuit. For the purpose of varying the power and speed to meet the requirements of the foundry, a set of resistance coils is provided governed by a special switch, by means of which different resistances can be introduced into the armature circuit of the motor, and the current can be cut off altogether; but so that it must be done by steps, and not suddenly. In starting the motor the reverse action takes place. The shunt coils of the magnets are connected to the two collectors so that the fields are always excited when the dynamo is running, whether the motor is working or not, the switch controlling only the armature circuit. The collector for the angle-iron conductor consists of a pair of insulated brass blocks pressed against it by means of a flat spring having a considerable range. An ordinary wire brush serves to collect the current from the rail; but the axle of one of the wheels is also connected to this brush to provide for the contact being in any way interrupted.

The handles for operating the several movements, the brake lever, the switch, and the automatic cut-out are all collected together, so that a single attendant can readily work the crane from one spot.

The crane was set to work in June last, and has continued to act satisfactorily ever since. The advantages of working by electricity are very great, especially in comparison to steam cranes. In large works a powerful dynamo would be established, and be driven by engines of an economical type. The steam from the main boilers is necessarily always available when the factory is at work, and the current can be easily carried into any part of the establishment. Steam cranes require the attendant to be at his post an hour or more before the works open, water and fuel have to be hoisted on to the crane, and the working is accompanied by dirt, steam and smoke, the latter especially objectionable with overhead lights, or in shops where bright work is prepared or erected.

The duty realized is about 65 per cent. of the power developed in the driving steam engine. As far as can be judged at present, there is no special wear to apprehend. The conductors act satisfactorily, though a considerable length is in the open air, and the dust, heat, and smoke of the foundry do not appear to affect the working.

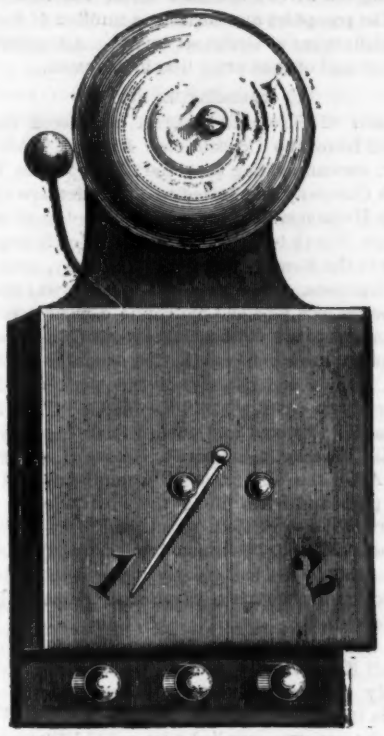
When first proposed the writer was not aware of the existence of any other electric crane, but he has since learned that Messrs. Mather-Platt, of Manchester, have had one working satisfactorily for some time, and that there is one also in France.

Lighting the Gedney Channel.—The special engine-house intended for service in lighting the new buoys that are to be placed in Gedney Channel, at the entrance to Sandy Hook, has been completed. It stands on a site at the point of Sandy Hook a few hundred feet south and west of the fixed light at the point. The buoys will be laid in about three weeks.

* Paper read before the British Association at Bath, in Section G, September, 1888.

A Two-Call Indicating Bell.

We illustrate on this page a "two-call indicating bell," which has recently been brought out by Partrick & Carter, of Philadelphia. It is simple in its arrangement, being upon the principle of the firm's well-known patent needle



TWO CALL INDICATING BELL.

annunciator. The pointer or needle always remains pointing to the last call, and the device automatically sets itself, requiring no trip or "set back."

The New Cox Gelatine Battery.

Among the exhibits at the Telephone Convention was that of the H. B. Cox Electric Company, of New Haven, Conn., who showed a number of the new Cox gelatine batteries, which attracted considerable attention. In order to avoid the use of cells containing a free liquid, Mr. Cox has designed his gelatine battery in which the active material is in solution with a gelatinous substance which is sufficiently solid to allow the cells to be placed on their sides and moved about without injury. The moisture contained in the cells when made is sufficient to keep them active during their entire life.

The gelatine employed is made by digesting Irish moss to a gelatinous mass, and adding thereto sal ammoniac and bisulphate of mercury. The galvanic action in the battery forms an amalgam on the zinc, which prevents local action, and keeps the zinc free from deposit, all waste products settling at the bottom of the cell. The cell for ordinary use has an E. M. F. of 1.5 volts. and gives ½ ampère on short circuit. On account of its portability the battery is well adapted to be moved about from place to place. Hence, one form of the cell has been embodied in a medical battery set. Our illustration shows the automatic medical battery of the company, containing gelatine cells in which the opening of the lid closes the circuit and renders the current available immediately; and vice versa, the closing of the lid breaks the circuit, and hence leaves no chance of waste. The instrument produces three qualities of current, viz., the galvanic, the faradic, and the galvanofaradic, which are all controlled by a switch, and which can be graduated from the mildest to the strongest.

The Storage Cars on the Fourth Avenue Road.

A very successful trip was made on Saturday, Sept. 15, by the first of the ten new st orage cars, of the Julien system, built to run on the Fourth Avenue Railroad in this city. The cars are built by Brill, of Philadelphia, and are the most massive and handsome that have ever been put on street car lines, the interiors being finished in carved hard woods and the windows being of beveled plate glass. The cars are 18 feet long, and have two four-wheeled trucks, each carrying a motor. Pending the publication of fuller details, it may be stated that the cars weigh altogether between 8 and 9 tons, and are provided with an equipment of 144 cells of Julien battery of a weight of 4,200 lbs. The car in use on Saturday last traveled with the utmost smoothness, and, whenever the track was clear, made a speed of 10 miles an hour. The electrical engineering work has all been done under the direction of Mr. C. O. Mailloux.

The Telegraph in China.—M. Lemaire, the French Plenipotentiary at Pekin, is negotiating at the present moment with the Chinese Government with a view of obtaining a convention permitting the Tonkin telegraph system to be connected with that of China.

Cuban-Mexican Cable.—The Madrid *Gazette* of Aug. 20 contains a Royal order granting permission to Don Augusto Ghirlanda y Hemandez to lay and work a submarine cable between the coast of the Island of Cuba and the Mexicon peninsula of Yucatan.

The Best Proportions for Permanent Magnets.

To the Editor of The Electrical World:

SIR: Your contributor, Mr. Oberlin Smith, in your issue of Sept. 8, says (p. 117): "He was somewhat surprised to find an equal amount (of ignorance) in several well-known electricians whom he consulted, and also to find that none of the books he had at hand gave any definite data regarding the best proportions for permanent magnets, or their actual strength—when saturated—in pulling power." He then suggests investigation into this subject. Allow me to point out that all *electricians* know of the works of Jamin on this subject as first published in the *Comptes Rendus* of the Academy of Sciences of Paris, which leave no question scarcely to be answered. My object in this notice is to prevent waste work on the part of those who might be led to do what has been so thoroughly done before.

LEONARD PAGET.

A New Miner's Lamp.

An exhibition was recently made at Cardiff, England, of a new miner's electric lamp, recently devised by Mr. J. P. Rees, of Swansea. The following description is given: The body of the lamp is composed of a vulcanite case, measuring 5¼ inches by 5 inches by 3 inches. To the lid is attached a small brass cylinder, and on this cylinder is placed an elongated glass dome, ⅛th inch thick. In the vulcanite case are four cells in separate compartments, containing a supply of carbon in porous cups, connected with zinc in the next compartment by means of a short brass pin, with screws at each end, and placed above the surface of the diluted sulphuric acid with which the cells are filled, the porous cups being filled with a liquid prepared by the inventor. Within the lid is a flat piece of India-rubber, covered with paraffin wax, and which prevents the liquids from mixing together or shedding while being carried. Inside the glass dome at the top is a bulb with an incandescent lamp, and the space between the bulb and the dome is filled with compressed air, forced from a small hand-pump through a tube, and prevented from escaping by means of a screw. This compressed air forces the bottom of the brass cylinder down, and thus the circuit is completed. The compressed air may be left in for an indefinite time, and the circuit broken by opening the lid alone. It requires great force to break the glass dome; but should it at any time be broken in the course of working, the circuit would be broken at the same time and the light extinguished before the bulb could possibly break, so that its safety would not even then be diminished, nor can it be tampered with without being extinguished. The light given in the first instance is of 3 c. p., but by means of a number of lenses it is magnified to eight times its intensity. The cost of the lamp is about $7, and it can be maintained for ten hours at a cost of 2 cents.

MEDICAL BATTERY WITH COX GELATINE CELLS.

Petroleum Fuel For Electric Light Stations.

To the Editor of The Electrical World:

SIR: In THE ELECTRICAL WORLD of Sept. 8, I notice that Mr. Fred. DeLand, of Chicago, says, in the report of the electric light convention, that the Louisiana Electric Light and Power Company have sunk two large tanks in the ground, each containing 100,000 barrels of oil. I think he has made a mistake somewhere; it should be 100,000 *gallons*, or a little over 2,000 barrels, as a tank to hold 100,000 barrels would have to be over 70 ft. in diameter and 100 ft. deep. I notice this in particular, as I have charge of the Tide Water Pipe Company's storage yard here, as well as the electric light plants for the refinery, and we have as large tanks as are usually built for storing oil, and they only hold 36,000 barrels.

W. M. MINER.

THURLOW, Pa.

The Electric Light in Artillery Practice.

To the Editor of The Electrical World:

SIR: In your issue 15th inst., page 149, the article "Artillery practice against electric light projectors" says: "The artillery officers are unable to explain the fixed difference between the day and night observations of the distance." In long range rifle shooting the same difficulty named above is often met with, and the elevation required to hit the bull's-eye has been found to differ between a bright sun-shiny day and a dark cloudy day. Also, if during the period of firing, the sun shone at one time on the target, and at another time was cut off by a cloud, a difference in results was found. Sir Henry Halford, of England, Frank Hyde, Major Fulton and others of the New York Creedmoor shooters could explain this better than myself.

S. E. BLISS.

CHICAGO.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
168-177 POTTER BUILDING, NEW YORK, Sept. 17, 1888.

Suicide of F. E. Beardslee.

I regret to have to note the suicide of Mr. F. E. Beardslee, a well known electrician of this city, who was found dead in the laboratory of the Denison Auto-Telegraph Company, 76 Beekman street, where he had swallowed a dose of chloride of potassium. Mr. Beardslee was the son of the late Rev. G. W. Beardslee, of Brooklyn, an electrician of note in his day, and had spent his life in electrical work of various kinds. In 1876 he went to Mexico to introduce electrical inventions there for a German house; but in time the climate destroyed his health, and he returned to this country. He was then for some time employed by the Cleverly Electrical Works, of Philadelphia, as superintendent of their factory; but after two years was compelled to resign on account of sickness. Mr. H. A. Cleverly speaks of him as "faithful and efficient in all his duties, upright and honest in all his dealings." He then came to New York and became interested in the construction of subways here. At the time of his death he had been given employment by Mr. Radcliffe, an old friend interested in the Denison system. His suicide was attributable to his despondency at his continual sickness and want of success.

The E. P. Gleason Company.

I understand from Messrs. Gennert and Cullen, general manager and superintendent for the E. P. Gleason Manufacturing Company, Mercer street, that the concern was never so busy as it is now in electrical glassware, electric lighting fixtures and other departments connected with electricity. The representatives of the company now on the road—Mr. H. D. Eames, of Chicago, doing the West, and Mr. T. M. Biglin, at New Orleans, doing the South, and Mr. L. M. Corwin, Syracuse, doing this State and the East—are already sending in excellent orders, and the result is that both the store and the factories are extremely busy. It will be some time before the company is abreast of the demand for its goods in various departments.

The Slater Process of Ore Reduction.

Mr. H. B. Slater, of Leadville, Col., has been in town for the last week or two, and reports preparations for some interesting work at Leadville, in the utilization of his patent process for reducing refractory ores by electricity. It appears likely that, when this work is in full operation, a very great economy will be effected in the treatment of ore, and, of course, the saving will represent a large return on the investment in plant. Mr. Slater tells me that a short time since he ordered a dynamo for metallurgical work from the Excelsior Electric Company, and that he has already been able to get $30 a ton from ores that were formerly considered utterly worthless. So successful was the performance that the parties interested in Leadville, as an expression of their pleasure, gave him a beautiful gold watch and a diamond studded Knight-Templar charm attached to a gold chain.

Excelsior Isolated Plant.

In a recent issue your Eastern correspondent gave some interesting notes on the arc plant recently put into operation at the Union Stock Yards, Chicago. I might mention that the Excelsior Company furnished the apparatus. It may be mentioned also that this company has now installed no fewer than 80 plants on steamboats plying on the Mississippi River. One of the latest orders received from that quarter is for nine 3,000 c. p. arc lights. The company have recently received orders for 35 arcs from St. Charles, Mo., and for 30 arcs from Providence, R. I.

Bishop Gutta Percha Company.

The above well-known and prosperous old concern, of 420-426 East Twenty-fifth street, are as busy as usual, and have a quantity of special work on hand. One of their latest pieces of work is that of the cables for Gedney's Channel, just completed, and now waiting to be tested. There are two three-wire cables, 16,000 feet each. The conductors are stranded, of seven No. 18 wires, insulated with three coats of gutta percha up to a diameter of ten-sixteenths of an inch. Then the conductors are covered with jute and armored with sixteen No. 4 iron wires. There is also a single conductor cable, composed of seven No. 18 wires, and armored with twelve No. 7 iron wires. This plant will be of a most interesting nature when finished, and has attracted a great deal of attention. The cost of the cables is $11,000.

Accumulator Plants.

Mr. H. E. Vineing, of the Electrical Accumulator Company, of this city, has just returned from Bar Harbor and Brunswick, Me. He has been busy in that State installing central station accumulator plants. At Cherryfield he has put in one of 350 lights, using 95 volt Sawyer-Man lamps. At Brunswick he has just put in one of 500 lights, using 95 volt Brush-Swan lamps. He tells me that Mr. Storey, of the firm of Grant & Storey, Bar Harbor, is constructing a fine water power station for electric light and power on the Androscoggin River, at Brunswick, which, when completed, will be one of the finest stations in that section of the country.

Reflector Shades for Incandescents.

As I anticipated and predicted on their first introduction, the beautiful reflector shades of Mr. A. A. McCreary, 18 and 20 Cortlandt street, have gone largely into use. They are now made in five sizes, for from 10 to 100 c. p. lamps. Over 4,000 are in use, and their peculiar availability for certain work is highly appreciated, while for ordinary situations they are declared by numerous electric lighting companies to be all that could be wished. In my peregrinations the other day, I was very much struck by their use in two totally different places. As I went down Cortlandt street my eye was arrested by the beautiful spectacle presented in the large jeweler's store in the Telephone building, where the incandescent lamps, run off storage batteries, are all inclosed in these shades, giving a light so soft and mellow, that, had Tom Moore seen it, he would certainly have worked a description of it into his "Paradise and the Peri." So much for the poetry of it. A few minutes later I happened to be passing along Park place, and there, in a large firework store, I found these reflectors in use protecting the incandescents, and providing an illumination which everybody could see was the safest and the best for the purpose. That was a practical demonstration, not less effective than the other.

Oxley, Giddings & Enos.

A very handsome display of electric fixtures, electrical glassware, and similar lines is being made in the salesrooms of the above firm, on 224-230 Canal street. The exhibit includes some new and very beautiful hall lamps and newel post lamps, etc., in designs illustrative of the latest fads and fashions. The company have a large factory in Brooklyn, and report themselves as very busy for this season of the year.

Some New Edison Plants in Jersey.

Mr. F. R. Chinnock, the Edison agent and contractor, reports business to be quite good in New Jersey. The following plants were ordered last week: St. Paul's Roman Catholic Church, Greenville, to be lighted by a 250-light dynamo with steam power complete. The bell chimes will be run by ⅓ h. p. Sprague motor and the organ will be pumped by a ⅛ h. p. Sprague motor. The fixtures are to be supplied by Bergmann & Co. Another order is for the Tiltz silk mill, Marlborough, N. J., where a contract has been closed for a 300-light plant.

The Electrical Road at Salem, Mass.

The length of the electrical road at Salem, recently equipped by Messrs. Sawyer & Blake, the Boston agents of the Sprague Company, of New York, is one and three-fourth miles, and the number of electric cars upon the road is six. They are all running smoothly and well, and it is said that the company intends to extend the line to Beverly with an increased electrical equipment. The cost of operating these cars by electricity is only 40 per cent. of the cost of operating the same number by horses. Altogether there have been set 175 wooden and 14 iron poles in the course of construction. The amount of wire used has been nine miles, including contact, main, feed, ground and span wire. The amount of line wire, that is, main wire, contact, ground and feed wire, is seven miles. The cars are fitted with lightning arresters, as are all the cars which have ever been equipped by the Sprague Company. For winter work, cleaning snow and ice, the Sprague Company has what it terms its working car. This car is fully equipped with plow, ice cutter, sand and salt arrangements, etc., and is driven by a powerful 40 h. p. Sprague motor. In front of the car is a revolving wheel which breaks up the snow crust, and behind is a revolving brush which sweeps the rails clean. In Carbondale, Pa., the car has worked with entire success. In Richmond there were two or three bad sleet storms last winter, but by putting a man on top of the car and knocking the contact wire with a short pole the ice was easily cleaned from it, and the regular line cars ran easily. To obviate the noise from the motors, the Sprague Company is attaching a very ingenious wood fibre substance to the gearings, making them absolutely noiseless. The fibre by a peculiar process, though it is composed entirely of wood, is rendered as hard as steel. The Salem electric cars make regular 15-minute trips to the Willows, and have carried heavy freights. One car recently took 110 passengers easily up over the steep grade at Fort Lee, a long hill which has frequently compelled three horses to succumb.

E. Gould & Eberhardt.

The above firm, of Newark, N. J., builders of first-class machine tools, record an excellent demand for their productions among electrical concerns. They are doing a good export trade by the way, and have recently made shipments to Buenos Ayres, Mexico, and Canada. They have received an order for the eleventh drill for one party who is using the Eberhardt drill process in sizes ranging from 30 to 42 inches. The concern are busy also on their regular line of tools.

The Gibson Electric Company.

This company, of 775 Greenwich street, is now busily engaged making its Gibson storage batteries for light, heat and power purposes. At a meeting of the Board of Directors, on Sept. 7, Mr. H. S. Iselin was elected president, Mr. W. S. Vernam, treasurer, and Mr. H. McDowell, secretary. The company has just closed an order for a central station in Boston, for the Walworth Electric Light and Power Company, for 46 cells. Gen. G. S. Brown, of Baltimore, is having a fine Herreshoff steel yacht built at Bristol, R. I., and she will be equipped with 60 cells of Gibson battery, having a capacity of thirty-five 16 c. p. lights for 4 hours, serving as an auxiliary plant when the yacht is at anchor and steam is shut off. Mr. G. C. Rand is putting in a plant of Gibson batteries at his private residence, Lawrence, L. I. He will have 30 cells of large size, equal, it is said, to running 50 lamps for 5 hours. In connection with this plant, the Gibson Company will install a 4 h. p. Shipman oil engine.

Cotton Leather Belting.

Mr. A. B. Laurence, agent for the Underwood Cotton Leather Belting, at 82 John street, reports an order of 1,000 feet of belt for the United States plant in the Post Office here. While in Mr. Laurence's store the other day, I was quite interested in seeing the men there making an endless belt, by severing the layers or plies of cotton at the end of the individual belts, and then bringing the plies together, so that they would fit each other accurately. It is necessary to use a knife, as the plies are so solidly cemented with the Laurence cement that they cannot be pulled apart. The two sides at the splice are reinforced with leather to strengthen it. With regard to the belt for the United States plant, I may mention that one of these belts was tried for a year, in competition with leather belting, and the results are such, I am informed, that the cotton leather belting will replace all the others there.

Isolated Edison Plants.

Mr. C. A. Benton, the energetic and popular Edison agent, has just closed a contract for the beautiful new apartment house, the "Gerlach," in West Twenty-seventh street. The plant will include 1,300 sixteen c. p. Edison lamps, and the dynamos will be driven by Straight-Line engines. Mr. Benton has also closed a contract for Collector Magone's suite of offices in the Custom House. The contract includes electroliers, portable lamps, etc.

The New York Insulated Wire Company.

The above company, of 452 Broadway, and of Boston, Mass., have just issued a very neat, tasteful and useful price list and catalogue. This little work gives a number of details as to the Grimshaw white-core, solid and stranded conductors, switchboard cables, Grimshaw tapes and splicing compounds, their D. B. braided wires, duplex fixture wires, competition line wires and their insulated galvanized iron wires. The testimonials that are given with regard to results obtained with these various specialties are very striking, and must convince any one that the products of the company are of the first-class, and thoroughly reliable. The testimonials come from electric lighting companies, telegraph companies, fire departments, telephone companies and others using the wires and cables under the most exacting conditions. The pamphlet also includes a number of formulæ, tables, etc., and definitions of electrical terms. Altogether it is one of the handiest and neatest price lists to be found.

Extending the Subways.

The Board of Electrical Control considered recently a communication from the Consolidated Electric Telegraph Subway Company, recommending that the Metropolitan Telephone and Telegraph Company be allowed to construct new subways as follows: On Hudson street, from Worth to Canal street; Centre street, from Worth to Reade street; on Worth street, from Hudson street to the Bowery, and on the Bowery, from Worth street to New Chambers. All of these subways, it was proposed, should be of wrought iron pipe and hydraulic cement concrete. On motion of Commissioner Gibbens the recommendation and accompanying plans were referred to the engineer of the board for approval, it being understood that the work could begin at any time after his approval without the necessity for further action by the board. The board adjourned until Sept. 18, when the report of Mr. Wheeler, the board's electrical expert, will be submitted. After the adjournment, Commissioner Moss stated that all of the poles and wires along the west side of Sixth avenue, from Thirty-fifth to Fiftieth street, had been removed, and that those remaining would be taken down as rapidly as possible. The removal of these poles had greatly changed the appearance of the avenue, which for the space mentioned seems to be much wider than formerly.

Light as well as Power.

The Daft Electric Light Company has been doing some good and highly appreciated work in the way of incandescent street lighting in the adjacent towns of Superior and West Superior, Wis. Each town was supplied with a 400-light installation, and a month later the latter was at the limit of its capacity, and a thousand additional lamps were engaged. Three 400-light dynamos were at once ordered, but before they could be forwarded, the demand had again exceeded the supply, and the race is still going on. Arrangements are also being made for a distributory power plant of considerable size. The West Superior circuit already comprises seven miles of wire, for domestic as well as street lamps. Daft power-plants are also in operation at St. Paul, Minn.; Cincinnati, O.; Richmond, Va.; and one of unusual extent will shortly be opened at Newark, N. J.

The demand for stationary motors is general throughout the country and increasing at a remarkable rate. In no other mechanical industry is the outlook so promising.

The Craig Telegraph System.

A despatch from Washington says: In the Senate last Thursday, Mr. Blair offered a resolution, which was referred to the Committee on Contingent Expenses, instructing the Committee on Interstate Commerce to examine fully into the system of mechanical telegraph now on exhibition at the Capital, and to secure the aid of competent and disinterested experts. He explained that the object of his resolution was to have this system of telegraphy examined, and, if found to be as represented, to secure it for the benefit of the people. He had been told by Mr. D. H. Craig, the owner of the patents, that 2,000 words could be sent on the wires at the cost of a single letter postage. The difficulty hitherto (for the process was not new) had been in the preparation of the message, but that difficulty had been largely obviated by the use of a machine somewhat after the fashion of a typewriter. Mr. Blair spoke of the Western Union Telegraph Company as a gigantic monopoly that owned every telegraphic invention and every telegraph line and wire in the country, and that it thus had a practical mortgage over the telegraphic business of the country, against which there was no redress unless Congress saw fit to interfere and buy out that company at an extravagant valuation. Here was an opportunity to introduce a system which would supplant the other at comparatively very slight expense. He did not know whether there was anything in it, but he wanted to have the matter considered.

Indurated Fibre Battery Jars.

The Union Indurated Fibre Company, 37 Barclay street, this city, have recently received a letter from General Greely, of the Signal Service, relative to the merits of fiberite battery jars furnished the department. These jars are reported upon by Lieut. Frank Greene, of the Signal Corps, in charge of the telegraph division. Lieut. Greene considers that these fiberite battery jars will make an excellent substitute for the glass ones which have been in use, as they will always retain their shape, are much easier to keep clean and renew, and are not liable to breakage from freezing or violence in transit.

New Sprague Roads.

During the past week the Sprague Electric Railway and Motor Company has closed three important railway contracts. These call for the electrical equipment of the Peoples' Street Railway of Erie, Pa., and the street railways of Reading, Pa., and Asheville, N. C. The first named company is the largest in the city of Erie, and operates twelve miles of track and over one hundred horses. The contract specifies for the equipment of twelve cars and overhead system. You have already published the details. The East Reading Street Railroad Company runs out Fairview avenue, and covers about a mile and a half of street. The same overhead system will be used as on all the Sprague Company's roads, and the poles will be of a neat and tasteful design. The president and directors of the Asheville railroad, before closing any contract with the Sprague Company, made a careful examination of the various electrical systems now in operation in this country. The road is three miles in length. At St. Joseph, Mo., the successful operation of the Sprague system on the road of the Union Passenger Company, of that city, has caused the company to adopt Sprague motors and overhead wiring for its cars.

The Electric Light in Cuba.

A special cablegram to the daily *World* from Havana, Cuba, stated that a local paper had made the charge that the new Havana Electric Light Company proposes to bribe the Havana

aldermen by giving them stock in the new enterprise, in order to secure the contract for lighting the city. President J. M. Caballos, of the company, was absent from his office at No. 82 Wall street, when a *World* reporter called last week, but a representative vouchsafed the statement that the company had never submitted any such proposal to the aldermen. "All there is about it is this: The Consolidated Gas companies were getting scared at the progress we were making and employed this infamous device to defeat us. The people of Havana want electricity, and I do not think the circulation of any such absurd stories will carry any weight. The gas company has been reaping a rich dividend from the enterprise and naturally will make every effort to retain the patronage. If we cannot get the charter by fair means I assure you we will not resort to trickery or bribery."

Perforated Leather Belting.

This is a novel method of preventing "air cushions" in belts run at a high rate of speed. The perforations are made in a regular and uniform manner and at equal distances apart over the entire surface of the belt, thus insuring equal tension and leaving the tensile strength of the belt uninjured. Besides preventing "air cushions" these belts run smoother, steadier and make less noise than ordinary belts. They are adapted to high speed dynamos, especially those, it is said, of the alternating current system. Chas. A. Schieren & Co., of New York, have been granted a patent on this article, dated May 24, 1888, and have, they state, just completed the machinery necessary for its manufacture.

The Callender Company

has removed from the Aldrich building to its new offices in the Telephone building, 18 Cortlandt street.

New York Safety Engines.

Mr. E. T. Copeland tells me that his company are having to meet a brisk demand for their vertical high speed electric light engine. The orders are running at the rate of about 1,000 engines per year. In the line of horizontal engines, from 6 to 200 h. p. the output is not less extensive to fill contracts in all parts of the country.

Personal.

Mr. H. L. Shippey, general agent of John A. Roebling's Sons Co., has just returned from an extended trip through the continent of Europe and the Holy Land. He has had a very enjoyable vacation, and brings back with him some interesting photographs, one of which shows him mounted on a camel, with Arabs around him, like any desert sheikh. Mr. Shippey returns home with the usual impressions as to the backwardness of the old world in electrical matters.

Mr. Fremont Wilson, general superintendent of the Julien Electric Traction Company, of this city, has been confined to his house at Harlem for the past two weeks, with a severe attack of typhoid. He has had a rather hard pull of it, and his friends will be glad to hear that he will soon be out again. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
178 Devonshire Street, Boston, Sept. 17, 1888.

Personal.

Mr. H. W. Blake, for some time past connected with the New England office of the Sprague Electric Railway and Motor Company, has accepted a position with the parent company at its New York office.

Mr. Frank J. Sprague, of the Sprague Electric Railway and Motor Company, of New York, was on a flying business trip to Boston on Thursday, Sept. 13.

Mr. Oscar B. White, electrician with the Brush Electric Company, of Cleveland, O., was in Boston last week. Mr. White will remain in this section for some time and will look after the installation of several Brush isolated plants.

Mr. E. B. Field, general manager of the Colorado Telephone Company, and whose office and residence is at Denver, Colorado, while on a business visit to the "Hub" last week was a guest at the Boston Electric Club.

Mr. David W. Dunn, for several years a supply agent of the Thomson-Houston Electric Company, recently resigned his position with that company and has accepted the management of the electric light station at Petersburg, Va. Mr. Dunn is known to nearly every manager and superintendent of local electric light stations in New England, and his standing among his business associates and numerous friends is a most enviable one. I join many in the sincere wish that Mr. Dunn will be prosperous in his new field of labor.

Mr. E. A. Babbitt, electrician of the Phœnix Electric Light and Coal Company, of East Greenwich, R. I., was in Boston last week. Mr. Babbitt has been identified with electrical interests in New England for some years past, including the Edison and Sawyer-Man companies. It was only of recent date that this gentleman accepted a position with the East Greenwich company.

Long Distance Telephone.

The New England Telegraph and Telephone Company has completed a copper-line circuit between Boston and Portland, Me., which is already rendering good service.

Electric Lights at Plymouth.

The Plymouth, Mass., Electric Light Company will soon be prepared to furnish both arc and incandescent lights. The company recently awarded to Messrs. John Post., Jr. & Co., of Boston, the contract to instal the equipment of the steam plant of its station. This equip will comprise an Ide compound condensing engine of 100 h. p., a Worthington independent condenser and pump, a Wainwright copper corrugated coil feed-water heater, a steel tubular boiler of 100 h. p., and a Park injector.

New England Wiring and Construction Company.

This well known concern has its hands full of orders just now. Among the most important of these is a contract for wiring the magnificent Raymond Hotel, at Pasadena, near Los Angeles, Cal., for 375 incandescent lights, Edison system. Three hundred of the lights will illuminate the interior of the hotel and the remainder will be distributed on the piazzas and grounds. The Hotel Vendome, one of the leading hotels of Boston, will also be wired for incandescent lighting by the Edison system by the New England Wiring and Construction Company. This plant will consist of 165 lights.

Sawyer-Man Plant at Florence, Mass.

The Sawyer-Man Electric Company through one of its agents, Mr. G. F. Talcott, has secured the contract for lighting the mills of the Nonotuck Silk Company, Florence, Mass., with 750 incandescent lights. Mr. Talcott secured another order recently for 455 incandescent lights (Sawyer-Man system) from the Glasgow Company at South Hadley Falls, Mass.

More Electric Lights for Pawtucket.

Information has been received from Pawtucket, R. I., that at a meeting of the Board of Aldermen of that city on Sept. 5 a vote of four to one was passed in favor of the city purchasing its own electric light plant. A few months ago the Councilmen of that city met and passed, by a vote of fourteen to one, a resolution in favor of the project alluded to. The Legislature of Rhode Island had previously granted to the city of Pawtucket the privilege of appropriating the sum of $75,000 for the purchase referred to.

The West End Electric Road.

The work of construction on the electric power station for the West End Road (Sprague system) at Brookline, has commenced. The building will be 72 × 66½ feet. The first portion of the steam equipment will consist of two 230 h. p. Armington & Sims engines with three horizontal tubular boilers, aggregating 500 h. p. The first portion of the electrical equipment will include four 80,000 watt dynamos. Space will be left so that the building will easily be able to double its steam and electrical capacity with increase of cars.

Electric Traction Apparatus.

Mr. Elias E. Ries, who has been in Boston for the past few weeks, has just perfected arrangements with a prominent Eastern railroad company for the equipment of their steam locomotives with his electric traction-increasing apparatus, which is to receive a thorough practical test in regular service. Mr. Ries claims that the use of this apparatus will increase the tractive power of locomotives about fifty per cent., or in other words, enable a 40-ton locomotive to do the work of a 60-ton engine, other things being equal. It will be remembered that this method consists in producing a temporary molecular change in the metallic surface at the points of contact between the driving wheels and track, by the passage of a low tension electric current from one to the other. This has been found by experiment to increase the friction to a very large extent, so much so in fact, that its application to steam locomotives bids fair to result in a noteworthy change in railroad operation, and to increase the carrying capacity of existing roads and motive equipment. Mr. Ries returns to Baltimore this week preparatory to taking charge of this installation. W. I. B.

MANCHESTER, N. H., Sept. 5, 1888.

Cotton manufacturing is the life of the city, and therefore it is but natural that it should have some of the largest electric light plants. The Amoskeag Manufacturing Company have quite a variety of systems, including 5 No. 8 machines and 5 No. 7 of the Brush system, running 375 2,000 c. p. lamps; 21 Weston machines, running 210 lamps; 1 Thomson-Houston, running 45 1,200 c. p. lamps, 1 50-light American, running 21 lamps; 1 300-light Edison, running 235 24 c. p. lamps, and 1 Forsythe incandescent machine, running 74 lamps 16 c. p., or a total of 650 arc and 309 incandescent lamps in operation, and a total capacity of over 700 arcs, which will soon be entirely utilized. This company also has a large amount of smaller electrical apparatus, including a 14-drive watch clock of the Howard make, a telephone line of eight stations for regulating the water in their canals and communicating with various parts of the works, and fire alarms, call bells, signal lines, annunciators, door bells, and electric gas lighting almost without number.

The Amory Manufacturing Company have one Edison machine running 334 lights of 16 and 20 c. p. The Manchester Electric Light Company was established five or six years ago, and is now running over a hundred lights of the Weston system and one machine running incandescent lights of the same system in multiple series. The Ben Franklin Company was organized by the gas company because the charter did not permit them to go into electric lighting. It is running two Thomson-Houston 30-light machines to their full capacity. The P. C. Cheney Paper Company have one 10-light Weston running full. The Amoskeag Paper Mills have a 75-light incandescent Brush machine. The Manchester Locomotive Works have one 8-light Brush machine and one 50-light American, each running full.

The city government have been investigating the subject of furnishing their own light, and a committee visited Boston, Portland, Lawrence and other places looking into the merits of the different systems. They were divided on the system, but unanimous in their belief that the city should own its own plant. At this time the local press and many prominent citizens protested vigorously that the city tax rate was already too high and carried the day. The committee then advertised for bids for 200 lamps, part on mast arms and part on posts, of 2,000 c. p. to burn all night and every night in the year, and the contract has been awarded to the Manchester Electric Light Company at 43 cents for mast-arm lights and 38 cents for post lights. Work will begin at once, and the city government being given their choice of systems voted to have the Thomson-Houston. They have also appropriated $5,000 for a police telegraph system, and representatives of different systems have appeared before the committee and described the virtues of their apparatus. Some one of them would probably have received the contract if they had not got to abusing one another, and finally it was openly charged that they were using "boodle," or trying to, on the "honest" aldermen. This brought the whole question into disrepute, and it was killed, not to come to life again, probably, until a new city government comes in.

The A. P. Olzendam Company, manufacturers of hosiery, have recently put in a one drive Howard watch clock.

PENNSYLVANIA NOTES.

PITTSBURGH, Sept. 7, 1888.

Bids for Lighting in Pittsburgh.

The City of Allegheny having advertised for proposals for the lighting of the city by electricity, the gas committee met last night to open the bids that had been handed in. Bids for renting lights to the city were presented by the Allegheny County, Duquesne and Fort Wayne Jenney Electric Light companies. Proposals for the sale of a plant to the city were also received from the Thomson-Houston, Indianapolis Jenney, Brush and Fort Wayne Jenney companies. As soon as the committee met, Mr. Scott, who represented the Duquesne Company, asked to withdraw his bid, stating that for certain reasons it was necessary to be done. He declined, however, to make known his reasons. The committee granted his request, and the bid of the Duquesne Company was returned. Mr. McGonnigle, representing the Allegheny County Light Company, immediately asked permission to withdraw the bid of the Allegheny County Light Company, stating that on account of the withdrawal of the Duquesne Company's bid they thought it advisable not to have their bid presented alone. This permission was also granted to them, and afterward to the Fort Wayne Jenney Company. All of the bids for isolated plants were laid over, and unopened, and the Controller was instructed to advertise for new bids, with the understanding that when the new bids were presented they would not be allowed to be withdrawn under any circumstances. The impression seems to be that the Duquesne Company wished to have their bid withdrawn, and that the Allegheny County Light Company's bid would then have to be opened and read, which, of course, would make public their figures, while in all probability the bid would be referred back, doing them much harm in having their bid and their figures given away to the Duquesne people. The Allegheny County Light Company, however, did not fall into the grave dug for them, and withdrew their bid as above stated. The prospect is that there will be much excitement within the next ten days over this prospective contract. What the chances are of the city buying a plant of its own is quite uncertain. There has been no appropriation made for it, and unless some special provision can be made the purchase cannot be made this year. The specifications call for plant of 287 arc lights, and 1,300 incandescent lights.

Electric Roads.

The Observatory Hill electric road is running very satisfactorily, and seems to be a great success. The New Brighton Turnpike road has been leased by a syndicate, who propose to put on an electric road, running to Bellevue borough. The city terminus of the new road will be in connection with the Pleasant Valley Railway Company, and the two roads will be operated in harmony. Nothing has been done as yet regarding the adoption of any particular system, but it is intended to have the very best that can be had.

The Tesla Motor.

The Westinghouse Electric Company are making some experiments with the new Tesla motor for street car service, and are very much encouraged by the prospects. They propose to take up the matter of power immediately, and have this system of motors introduced as rapidly as possible.

Underground Telephone Wires.

The Central District and Printing Telegraph Company, of this city (Bell Telephone), have completed their extensive underground work in Allegheny, and they are busily engaged in connecting their telephone service with their new offices of Sandusky street, which they will push as rapidly as possible. For quite a time now they have had a large force engaged in taking down the old wires and in cleaning up the poles. Their new exchange is said to be one of the finest and most complete telephone exchanges in the country. A. B.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
44 Lakeside Building, Chicago, Sept. 15, 1888.

The Minneapolis Exposition.

The Brush Electric Company has recently sold a large incandescent electric light plant, consisting of 1,000 incandescent lights, to the Minneapolis (Minn.) Exposition. The same company have also rented to the management 180 arc lamps. This exposition is one of the most successful in the country.

The Northern Copper Mines.

Mr. Geo. Cutter, electrical engineer of the Western Department of the Thomson-Houston Company, has just returned from a trip north through the copper regions. He sends me the following letter, which I think cannot fail to interest electricians in general. He has also told me of the compressed air system used in some of the mines, and in his opinion the electric motor, were it in use, would do away with the many delays caused by the use of that system:

"While on my trip north I met many things of interest to an electrical engineer, especially in the copper regions. The town of Marquette is very important as a shipping point for the iron ores, there being three long piers especially built for this purpose, arranged with hoppers and sliding doors, so that the iron ores can be dumped from the car into the hoppers and then they are passed directly to the hold of the vessel. These hoppers are all numbered and the different kinds of ores are assorted and sent to special hoppers. A train load of iron ore does not look very much like a dynamo-electric machine, to which the imagination of an engineer traces it. I presume, however, that some of the ore which I saw at Marquette would soon be in my hands as parts of some electric machinery. This is very probable, as some of the ores there are of fine quality and used for the best classes of iron and steel. The piers for unloading the ore are lighted by arc lights. At Houghton and Hancock we found quite an extensive street lighting plant of the system especially familiar to the writer, but the wire work and general construction attracted my attention. The fine construction was especially noticeable at Houghton. These towns are both of considerable importance, though not very large, and not particularly attractive to a Chicago man. Several of the mines on the mineral range which projects out into the

lake were lighted by electricity, that is, *above* ground; whether any of them are lighted below ground, I do not know. I was a little surprised to learn that all the copper found in this region was pure copper, there being no ores worked through that section of the country. The vein containing copper is of a coarse, pudding stone, or conglomerate, simply filled up with pure copper, almost as though the master of the furnace had upset a kettle of copper on a pile of pebbles. The vein is from 12 to 15 feet thick, and especially rich in copper, there being very little of other metals found, although pure silver is occasionally met with. These mines are worked on levels of 100 feet each, and the Calumet mine was at work at the 39th level, viz., 3,900 feet deep, at the time of the fire. The water filled the mine to the 25th level, and all known methods have been used since for getting the water out. At present they have the mine clear to the 30th level, and took stone out for the first time since the fire while I was there. The Calumet & Hecla Company also own mines at South Hecla, known up there as the Black Hills, and these mines have been worked to the full extent during the recent high price in copper. In fact, these mines have yielded the company nearly as much copper per week, since the fire in the large mines, as all their mines together had done previously, the output being in the neighborhood of 100 tons per day. The ore is crushed or really broken into small lumps as it comes from the mines, and is assorted, part of it going to the stamp mills, where it is simply pulverized for washing and smelting. A large portion of the copper, however, is found in very large chunks, some of the specimens which I brought home with me being broken from chunks of 75 and 100 pounds, but pieces are often found weighing many tons. These, of course, are very difficult to remove from the mine, as they have to be cut to pieces with hammer and chisel. It is interesting to know that the Calumet & Hecla people are now taking copper from their old mines, and that the water is being lowered very rapidly, as the lower levels were not very much worked, and, therefore, did not contain much water. The last day I was at Calumet they lowered the water 22 feet in 24 hours. There are several other mines along this same ridge, and when not compared with the Calumet & Hecla, appear very large indeed. The operation of the old mines of the Calumet & Hecla Company will increase their capacity to about 200 tons per day, which may have some influence upon the price of copper. On the return trip we did not learn much about electric light, but were especially pleased to notice that several small towns along the route (which was, of course, through the lumber regions of Northern and Southern Michigan) were lighted by arc lights, and the writer met very pleasant surprises in seeing the lamp with which he is especially acquainted hanging up in places where he did not know his pet system was in use."

Elevated Roads.

One of the absorbing topics of the day at the present time is the discussion of elevated road schemes. Wednesday night of this week a well-attended meeting was held at the Princess Opera House on the west side, a call for same having been issued by the West Chicago Rapid Transit Company. This was the first public meeting held since February, and the interest manifested demonstrated that our west side citizens are awaking to the necessity of doing something. From a report of the work accomplished it was shown that the committee appointed for that purpose had recommended the adoption of a system with upright posts at the curb line, supporting iron and steel trusses on which should be constructed a double track It was also decided to increase the capital stock to $6,000,000. The company have at present an ordinance before the Council. Mr. Yerkes and his cable road were given a scoring, as were also one or two promoters of elevated railway systems. The directors of the Consolidated Rapid Transit and Elevated Railroad of Chicago held a meeting the same afternoon in the offices of the company in the Brother Jonathan building. At this meeting it was announced that the consent of the property owners on State street had been obtained for the proposed road, and that all that was required was an ordinance from the City Council. Action upon the ordinance submitted to the Council some time ago is expected to be taken in the course of a week or two.

From St. Louis.

The Metropolitan Electric Light Company, recently organized in this city, are putting in two 30 arc light dynamos of the Excelsior system. The company expect to soon increase the plant with 100 more arc lights of the same system.

Lighting Steamboats.

Wm. Oswald, of New Orleans, ordered this week, through the Western department of the Excelsior Company, four complete steamboat outfits of the Excelsior make.

Leadville, Col.

The American Mining and Smelting Company, of this city, have just ordered an electric light plant consisting of 25 arc lights of the Western Electric Company, of Chicago.

Western Electric Company.

Among other recent orders for electric lights was one consisting of 300 lights given by the Consumers' Electric Light Company, of Chicago. Marshall Field & Co., the well-known dry-goods merchants, have ordered of this company for their retail store 30 stations of speaking tube telephone. In its cable department the company are very busy just now. Among recent orders for their well-known Patterson cable is one from the Chicago Arc Light and Power Company; also one from the East River Electric Light Company, of New York, for some two miles of same.

Sioux City, Ia.

The Sioux City Electric Light Company are increasing their plant with 35 Thomson-Houston arc lights.

Cleveland, O.

The Cleveland Electric Light Company have just purchased 50 arc and 600 incandescent lights of the Western Department of the Thomson-Houston Company.

The Inter-State Industrial Exposition.

The sixteenth annual Inter-state Industrial Exposition opened most auspiciously on Wednesday night, the 5th inst. The exposition building is one of the largest of its kind in the country, and on this occasion it was filled almost to overflowing. The electrical display is this year larger than that of last, and is worthy of special mention. The installation by the Western Electric Company of the electric lights used in lighting the building, both inside and out, reflects great credit upon that company. The light produced is clear and beautiful, and the dynamo machines generating the current, are a constant wonder to the people not versed in the "subtle science." A display of motors is made by the Belding Motor and Manufacturing Company. The McIntosh Galvanic Company also exhibit a dynamo of new design for medical purposes. Exhibition of other apparatus, I am informed, will also be made, of which, when everything is running, I shall have something more to say. Within a few days everything will be in running order.

Saginaw, Mich.

The Saginaw Manufacturing Company, of this city, are putting in an isolated plant of 250 incandescent lights of the Thomson-Houston system, for lighting their mill.

Eau Clair, Wis.

The Rust-Owen Lumber Company, of Eau Clair, have just purchased of the Western Department of the Thomson-Houston Company 150 incandescent lights, for lighting their mill.

A Long Life Lamp Record.

The Eden Musee, Chicago, is lighted with 400 incandescent lamps of the Thomson-Houston system. The lamps are in use about fourteen or fifteen hours per day. Recent tests were made which showed the average life of the lamps to be over 1,400 hours each.

An Exciting Ball Game.

A nine selected from the Western Department of the Excelsior Company and one from the Western Department of the Thomson-Houston Company played a game of baseball on the 1st inst. at Washington Park. The errors, of which there were many, provoked much mirth among those who witnessed the game. At the end of the ninth inning the Excelsiors were declared victors by a score of 21 to 20.

The Electrical Supply Company.

The Electrical Supply Company recently sent out postal cards to electrical people in various parts of the country asking: "Can you give us any information we can make money out of, or can we help you any way?" I was recently in the office of the company and saw some of the replies received. Many of them were of a very humorous nature, while others were entirely matter-of-fact, giving information regarding new installations, etc. Among them was one stating that a new electrical supply company was about to be started and asked them to take 20 per cent. of the stock of the concern, paying 25 per cent. of the subscription in cash and the balance in goods; another one advised them to sell a particular line of goods manufactured by that firm; while still another was from a person suggesting that they employ him as a traveling salesman, that he was a "*hustler* in making sales and would like an opportunity to travel."

The Electrical Construction Company

Are at present busy with construction work. They also report doing a very large business in storage batteries, which they are now making a specialty of.

The Butz Thermo-Electric Company.

The Butz Thermo-Electric Company, consolidated the Butz, and a number of other patents bearing on temperature regulation. The new company is called the Consolidated Temperature Regulator Company, the capital stock having been increased from $250,000 to $500,000. The stock holders comprise some of the most promising and enterprising business men of that growing city. Among them may be mentioned Mr. Haskell, editor of the Minneapolis *Tribune;* Mr. Palmer, formerly editor of the *Northwestern Miller;* Mr. A. B. Robbins, general manager N. W. Elevator Company; Mr. J. H. Ames, purchasing agent, Northern Pacific; Mr. O. C. Green, general superintendent telegraph of the Northern Pacific. Mr. A. C. Paul is the secretary.

The New York Safety Steam Engine.

Mr. Wm. A. Hammett, the Western manager of the New York Safety Steam Engine Company, is at present pretty busy in taking care of orders for his engine. Among stations recently equipped may be mentioned the following: Three 160 h. p. engines for the new central station of the Minneapolis Edison Electric Light and Power Company; 250 h. p. of engines to the American Electric Light Company, Kansas City, Mo.; the Louisville Electric Light Company, United States system, 150 h. p.; one 100 h. p. to the Columbus Electric Light and Power Company, Columbus, O., being the eleventh already in operation at that station.

The Merchants' Company.

The Merchants' Arc Light and Power Company, of Chicago, was granted an incorporation license last week; capital stock, $30,000; incorporators, William H. Collins, Joel W. Stevens and Benjamin Keigher.

Proposed Telephone Ordinance.

An ordinance was presented last Monday evening to the city council giving the Chicago Telephone Company the right to lay wires in that portion of the city where they are now underground in conduits, outside that territory along properly constructed poles. The company offers to supply telephones to the city public offices free of charge as a consideration for the franchise and to comply with the other provisions of the old ordinance, which has expired by limitation. There is no limitation as to charge. The ordinance was referred to the Committee on Fire and Water. Alderman Landon said he did not know who drafted it. The ordinance was handed to him as he came to the council. He introduced it because he thought there ought to be some ordinance. The telephone was now operating without legal authority. The ordinance introduced could be made the basis of action; it should, of course, be amended. Both a maximum rental should be stipulated and a license fee provided for.

Joliet, Ill.

The Joliet Electric Light Company have had in successful operation for about a month their plant, consisting of 105 arc lights of the Waterhouse system, recently installed by the western department of that company, C. F. Dunderdale, manager. These lights have been used for commercial purposes. The company are now putting in 50 additional lights for lighting the city, the committee appointed for that purpose having decided, after investigation, that the Waterhouse was best suited to their purposes. The Joliet Steel Works have also just started up their plant consisting of 50 Waterhouse lights.

An Electric Light Plant Fire.

The North Side plant of the Chicago Arc Light & Power Company, running four dynamos, operating 155 arc lights, was burned down Monday night of this week. About 90 lights were immediately connected with the central station, so that no serious trouble has occurred. It is thought that the dynamos are not entirely destroyed. I am assured by President Sunny that the plant will be running again in a few days.

A New Enterprise.

Mr. H. C. Sample, formerly Superintendent of the McIntosh Battery Company, recently resigned his position and has just opened up a store at 298 Dearborn street, where he proposes to carry a full line of physicians' electrical supplies. He also purposes to carry in stock a full line of test instruments, comprising voltmeters, ammeters, etc.

New Electric Light Companies.

On Sept. 11 incorporation licenses were issued at Springfield, Ill., to the following:

The Clinton Electric Light, Heat and Power Company, Clinton; capital stock, $25,000; incorporators, Vespasian Warner, Clifton H. Moore, John Warner, Abner R. Phares and Richard Butler.

The Chicago Electric Light Enlarging Company; capital stock, $5,000; incorporators, Adolph Graeff and E. Graeff.

The Nutting Electric Mfg. Company.

An incorporation license was this week granted the Nutting Electric Manufacturing Company, Chicago. The capital stock is $100,000. It is understood that the company is formed for the purpose of manufacturing electrical apparatus. The incorporators are Samuel F. Nutting, W. H. Foulke and J. W. Hefenburg.

Clean Machinery.

The Baker Electric Company, of Keokuk, Ia., ordered this week a quantity of Tripoline of the Matchless Metal Polish Company for use on engines, lamps, etc. Shipments were also made this week of these goods to the Chicago N. W. R. R, Chicago, Rock Island R. R., U. S. Navy Yard and others. Mr. F. G. Baker, the manager of the company, is in the East on a business trip.

Electric Power in Chicago.

The Rand & McNally Map and Atlas Publishing Company, of Chicago, Ill., have decided to introduce electrical power into their large factory, and have ordered from the Sprague Company a twenty-five horse-power motor for use in running their presses. The Rand & McNally Company is probably the largest in the country engaged in the publishing of atlases and maps, and their work is one in which great care must be taken to keep the presses at constant speed and under perfect control.

The Hill Clutch

has become very familiar now to electric light men, and even had it not been, would certainly have secured the prominence it deserves after the good work done by Mr. W. C. Wonham, Eastern manager, in bringing it to the notice of those in attendance at the Electric Light Convention.

A Cleveland, O., Electric Road.

The East Cleveland Railroad Company have just closed a contract with the Sprague Electric Company for the construction and equipment of their line, everything to be in operation by Oct. 1. The power-house will be erected forthwith and will be 93 × 125 feet. Four Edison dynamos of 40,000 watt capacity, representing 375 horse-power, will be put in to begin with, but the building will be so arranged that without changing its line the motive power can be increased to 1,500 horse-power. Sixteen car bodies have been ordered (four from the works in Brooklyn). They will be four-wheel cars with two axles, and each axle working independently will have an electric motor from the Schenectady Edison Machine works. Each of these motors is of 7½ horse-power normal and is guaranteed for 11 horse-power on emergency, and can work up to 30 horse power for short distances. The cars will all be equipped with lightning arresters as are all the cars which the Sprague Company have put in operation.

A North Side Elevated Road.

An elevated road for the North Side is reported to be projected. The name of the new organization is the Chicago, Lake View & Evanston Rapid Transit Co. The capital stock is $8,000,000 and the proposed issue of bonds for $4,000,000 to bear interest at five per cent. and run forty years. Certain financiers, it is said, have agreed to take the bonds. It is proposed to construct the road along Wells street, thence into the northern suburbs. The Sherman system, which includes an electric motor, is proposed. The right of way, it is claimed, has been granted from Lake View to Evanston, and property owners for right of way on Wells street are now being solicited. A number of local capitalists have been approached with reference to the undertaking, and some of them are reported to have the question of investment under serious consideration. The corporation, however, has not as yet been fully organized, nor has any material progress been made in getting right of way in the city.

Kansas City, Mo.

I take the following from the Kansas City *Commercial*:

The Edison Electric Light Company have started on the erection of their new building and incandescent light plant at what will be the corner of the new Wall street north of Seventh and in the rear of 115 West Sixth street. Excavating for the new electric light building has been in progress for some days. Three years ago, Mr. Ed. R. Weeks, manager of the Kansas City Electric Light Company, with a number of prominent business associates, started the plan of building a new and powerful station at at the place named as an adjunct to their station at Eighth and Santa Fe streets. The Kansas City Electric Light Company purchased the lot. It was found difficult, however, to raise the money for a plant, sufficient, in the minds of the projectors, to supply the needs of the city. From $400,000 to $500,000 was required to put the station, as originally planned, in operation. A franchise was granted to the Edison Electric Light Company, requiring them to place their wires under ground. The new company leased the lot on Wall street, and have commenced the erection

of a building. The new station will be supplied with twelve 200 horse-power engines, and will have a capacity for furnishing 30,000 incandescent lights. Incandescent lights and power only will be supplied from this station. The station at Eighth and Santa Fe streets will be used exclusively to supply the arc light current. E. R. Weeks is manager of both companies.

A building costing $30,000, supplied with $75,000 worth of machinery, will be erected at present. The plans show a building 54×96 feet, with very heavy walls, fire-proof iron girders and partitions, that can ultimately be run up to a height of ten or eleven stories. Only the basement and first story will be erected at this time. The new station is expected to be ready for occupancy in November.

The Elgin Telephone and Electric Light Company,

of Elgin, Ill., have issued a very handy and complete catalogue and price list of electrical supplies. The company is evidently determined to do a large business in its territory, and its catalogue is a stout pamphlet of 50 pages copiously illustrated. In addition to cuts and descriptions of apparatus for sale it includes some useful information as to telegraphy for public and private use, and a large section is devoted to the well known Elgin Acoustic Telephone. The company also issues a small vest-pocket price-list of the same class of goods.

Wood-Working Machinery.

The W. F. & John Barnes Company, of Rockford, Ill., have just published a new edition of their handsome catalogue of foot, hand and steam power machinery. The firm have long been known for the ingenuity, cheapness and convenience of their machinery to be run by foot power, and this catalogue bears evidence as to their ability to produce new machinery for hand work, and to make such improvements on the old apparatus as may be suggested from time to time. Very full details are given as to their hand circular rip saws, foot-power mortising machine, foot-power former, band-tenoning machine, lathes, grinding and polishing machines, drills, emery grinders, etc. In all these and other lines the firm stands at the front, and they claim to be the only manufacturers in the world who are able to furnish complete outfits of foot and hand-power machines for mechanics and artisans.

Successful Working of Quotation Dials.

The quotation dials on the Board of Trade, worked by the Pencek mineral wool batteries, were put into service on Thursday of his week for the first time, and are said to be working successfully.

The Western Engineering Company.

A correspondent at Kearney, Neb., writes me as follows: The large incandescent plant being erected by the Western Engineering Company, of Lincoln, in Kearney, Neb., is now well under way. The dynamos driven by the magnificent water power of Kearney were started up on regular commercial work Sept. 1. On Aug. 31 a trial run was made to supply current to a 30 h. p. Sprague motor in the works of the Kearney Brick Co. Mr. M. E. Hunter, of the Brick Co., who is well known to many eastern electricians through his former connection with the Pond Self-Winding Clock Co., experiences pleasure at again winding by electricity. This company will in a day or two have a second motor of 20 h. p. in place, when they will turn out brick of best quality at the rate of 50,000 per day. This is the first utilization of the water power which is bound to make Kearney, Neb., a large manufacturing city. The Hiawatha Kansas Electric Light Company after months of consideration have awarded their contract for an incandescent plant to the Western Engineering and Electrical Co., of Chetopa, Kan., agents of the Edison Co. The Hiawatha Company are so well satisfied with the installation of their arc plant put in by the Western Engineering Co. that they will have the latter company build their plant.

The Western Engineering Company have just been awarded contract for isolated incandescent plant—Mather system—to be placed in the County Court-House at St. Joseph, Mo., Iowa Institution for Deaf and Dumb at Council Bluffs, Ia., and a paper mill at Lincoln, Neb., making an aggregate of 630 lights. Competition for the plants in the two former places was severe, and the awards were made to the Western Engineering Company on account of the superior excellence of their system and installation specifications, at prices considerably above those of some of their competitors.

Personals.

Mr. Foree Bain, electrical engineer, of this city, is building a 1,000-light incandescent dynamo, which will be used for a private enterprise.

Mr. Geo. Cutter, of the Thomson-Houston Co., was married to Miss Inez M. Gass, at Danville, Ill., Aug. 29. After a short western trip they will return to Chicago, where they will make their home.

Mr. Geo. A. Mayo, the well known electrician, formerly of New York, has connected himself with the Van Depoele Electric Mfg. Co., of this city.

The Bliss Shafting and Pulley Company.

The Bliss Shafting and Pulley Co. are furnishing the Rockford Electric Light Co. with shafting, steel rimmed pulleys, friction clutch pulleys, etc., for their new plant.

Telephone Quotations.

Col. S. G. Lynch, broker, 146 La Salle street, furnishes quotations upon telephone stock as follows:

Bell of Mo.	$150@	$155	Iowa Union	$28@	$29
Central Union	47@	48	Michigan	81@	82
Chicago	340@	345	Missouri and Kansas	70@	71
Colorado	43@	46	Rocky Mountain Bell	41@	43
Cumberland	65@	68	Wisconsin	110@	112
Great Southern	34@	37		E. L. P.	

SOUTHERN NOTES.

BALTIMORE, Md., Sept. 12, 1888.

When the Baxter Electric Motor Company's new workshops are completed they will rank as among the finest and best constructed in the United States. A view of the inside shows them to be spacious, elevated and most healthy, due regard being given to the sanitary arrangements throughout. The engine is in location, and the work of piping is well under way. The millwrights are now busy erecting the shafting—the greater part of which is already in position. The most important step now to be taken, and which needs the greatest amount of ingenuity, is removing the machinery, so as not to interfere with the present manufacture of the motors, and keep pace with their increased demand. In view of this the company has deemed it necessary to install and put into operation some of its new machinery before attempting to remove from the old shops. The new factory will, no doubt, be in full operation by the middle of next month.

The Johnstown, N. Y., Electric Light Co. have recently installed a power-plant with which to supply current to operate Baxter motors in Gloversville and Johnstown. They are introducing these motors rapidly in both of these places, and are meeting with unusual success. The Wheeler and Wilson Company's representatives in Johnstown recommend the Baxter motor to their customers in the strongest terms. The following is what they say in one of their notices in the Gloversville *Daily Leader:* "Our machinery is driven by the celebrated Baxter electric motor, and a constant use of this power in our machine shop in Troy for the past year enables us to recommend its adoption as an economical, reliable motive power."

ENGLISH NOTES.

LONDON, Aug. 22, 1888.

Central Station Lighting in England.

I am very sorry to say that the position of central lighting stations in this country is still, in many cases, far from satisfactory I am not much surprised to learn that the Bournemouth Electric Lighting Company is to be wound up by voluntary liquidation. This is one of those instances which, it is not too much to say, have been the curse of electric lighting in this country. The promoters of the scheme were men without capital, without experience, and, as I happen to know, without any real knowledge either of electricity or of engineering. These men go down to a wealthy town like Bournemouth with a small portable arc plant. They talk over one or two men of local influence, and then they hold a public meeting, at which they pose as leading exponents of the march of science. The townspeople, dazzled by the effect of half a dozen arcs, find it impossible to doubt their skill or their ability to run a central lighting station of any imaginable magnitude. Resolutions are proposed and seconded to the effect that a local electric lighting company be established. A site is secured, and after much delay a certain amount of plant is obtained on credit, a few lamps are set burning, and then shortly the difficulties begin. The light is subject to frequent restrictions, owing to inefficient management, the gas company lowers the price of gas, and nothing more can be done without increasing the paid-up capital. But the shareholders are not satisfied with what they have so far seen for their money, and before long the whole affair goes to smash, and then we read of another failure of the electric light. This story with variations has been repeated not once or twice, but a dozen times in this country within the last ten years, and the latest instance at Bournemouth is one of the most flagrant of any. At Eastbourne the difficulty is, that although the company has made a success of its private lighting—where Lowrie-Hall transformers are used—yet the public street lighting has resulted in a heavy loss. The corporation have been paying £25 per 10 ampère arc per annum, and are willing to meet the company by increasing the rate to £30. The contractors, however, ask for £35. The Pilsen-Joel Company having failed to find a purchaser on terms satisfactory to the shareholders, has gone into voluntary liquidation. This company own two small lighting stations in London, which seem to have been paying their way, but the losses met with in their manufacturing account have been very heavy. Mr. Gwynne, of the well known engineering firm of that name, offered £6,000 in cash for the whole concern, but although the directors recommended that the offer be accepted, the shareholders declined to sanction the arrangement.

Breakdown of the Australian Cables.

The Australians seem to have been infected with some of the nervousness now prevalent in the Mother Country in consequence of the results of the recent naval manœuvres. The late breakdown of the two cables which form the only communication between England and Australia gave rise to a veritable scare in Melbourne, and to quiet the alarm and test the defensive capabilities of the colony, Sir James Lorimer, the Minister of Defense, called out the artillery and naval reserves. Since this there has been another rupture of an even more important character. Our telegraphic connection not only with Australia and New Zealand, but also with India and the far east, is nearly severed by the simultaneous interruption of the Aden-Bombay and Persian Gulf cables. Consequently our communication with these and other countries depends upon the maintenance of two overhead lines, one running through Russia and Siberia and the other through Turkey. This is naturally not a condition of affairs at all pleasant either for us or for the colonists, and an angry outcry may be expected.

Artillery and the Electric Light.

The electric light seems destined to play almost as important a part on land as on sea in the next big European war. The Austrians are constructing portable electric light plant to be used in entraining and detraining troops at night. The Germans are going to have a similar portable plant attached to their siege trains. Finally some English batteries, now engaged in experimental practice at Dartmoor, have been amusing themselves by endeavoring to destroy some electric lighting apparatus erected by a party of engineers from Chatham. Up to the present only a minimum of damage has been done to the reflector. The experiments have been made on the basis that the search light is being used by an enemy advancing on the camp. Whether we are to attribute the immunity of the plant to bad shooting or to the blinding effect of the ray, is not mentioned.

LONDON, Aug. 29, 1888.

The Lineff System of Electric Traction.

A report has recently been furnished by Mr. Gisbert Kapp on the Lineff system of electric traction. This is a conduit system, and its special feature consists in the method by which the current is taken off from the mains, and the means by which a very high insulation is secured. Nearly the whole length of the conductor is insulated, and the current is taken off at certain points, about three feet apart. At these points are fixed small saddle-shaped contact pieces, over which trails the bight of a metallic rope, suspended from shoes which pass through the slot of a channel, and are attached to a flexible beam under the car. The rope consists of a stranded wire cable protected with gun metal ferrules, which can be easily renewed when worn. It is insulated from the shoes which pass through the slot, and the connection between it and the main controlling switches is also insulated. The rope in passing over the contacts collects the current, which is led thus to one of the main controlling switches and from thence to the motor, returning through the framework and wheels of the car to the rails. Now, in other systems of underground conductors the metallic surface is exposed from one end of the line to the other, and the leakage resulting therefrom must obviously be very much greater than with Mr. Lineff's arrangement, where nearly the whole of the conductors may be covered by insulation, and only a few inches of metallic surface are exposed at intervals. Mr. Kapp, in testing the insulation resistance of a line which has recently been laid down between Kew Bridge and Hammersmith, found it as high as 1,000 ohms per mile, even in very wet weather, whilst in dry weather the insulation was about two and a half times as great. This is, I believe, the best record at present made for an underground conductor of this description.

Some English Telephone Systems.

The *Financial News* publishes a long and interesting article in the shape of a special report upon the London, Manchester and Glasgow telephone systems, with the view to showing that the United Telephone exchanges are worked upon a thoroughly played-out system. According to this writer there are at present in Glasgow 1,570 subscribers connected with six exchanges, which are respectively joined together by means of from 8 to 25 junction wires. In this respect the Glasgow system resembles that of London, except that in London there are no less than twenty different exchanges. It is fully admitted that the only satisfactory system is that of connecting all subscribers in one town to a single central exchange. This has been done in Manchester, where there are at present 1,350 subscribers. In Glasgow silicon-bronze and hard-drawn copper wires are alone in use. The gauge is No. 18, and the weight only 35 pounds to the mile. All the wiring is overhead. On the principal routes the iron standards are able to carry nearly 1,000 wires each, and are supported by five poles; as the distance from the exchange increases and the number of wires becomes less, the poles are reduced to two, with 30 cross-arms carrying 10 wires each; further on still, a single pole with 20 cross-arms carries upwards of 100 wires. In Manchester Glover's anti-induction cables are largely used, and wooden instead of iron poles are employed. Most of the cables contain 20 wires and some of them are lead-covered. In London massive angle-iron, tower-shaped fixtures are erected where the wires are the thickest, but in no case do these towers carry more than 400 wires each, and quite the majority of the London lines are carried by single iron poles bearing no more than 20 to 30 wires apiece. Overhead cables are also very much used, but not to the same proportional extent as in Manchester. The earth connection is very carefully considered at Glasgow, and in every case a wire is taken to the nearest water-pipe, whatever the distance may be. With regard to switch-boards, both Glasgow and Manchester use the "multiple," but in London only three of the largest exchanges have as yet been fitted upon this system. This fact in itself goes far to explain the inferiority of the London service. Again, as to ringing off. This is not done automatically in Glasgow, and the operator has frequently to "cut in" to find out when the conversation is over. In Manchester a system of polarized relays is adopted and each subscriber is provided with two different colored push-botton switches, one of which is used to call the exchange and the other to ring off. London is in the same position as Glasgow in this respect. In the exchange itself, both at Manchester and Glasgow, the current is obtained by magneto generators driven by water power, and magneto calls are also extensively used by the subscribers. The London exchanges are worked from batteries, and the subscribers are supplied in some cases with batteries and in other with magnetos. With regard to the practical working, there is no doubt whatever that both in Manchester and in Glasgow the service is of a satisfactory character and quite the majority of the subscribers are perfectly content. This, as you will be already aware, is far from being the case in London.

Incandescent Lamp Litigation.

Mr. Arthur Shippey has once more appeared upon the scene in the attitude of Ajax defying the lightning. In case your readers do not know who Mr. Arthur Shippey is, I may say that he is well known in this country as a maker of incandescent lamps of low resistance, and as a most determined opponent of the Edison-Swan monopoly. Some twelve months ago he was pounced upon by the last named company, and during a preliminary skirmish in the Chancery Courts, he was ordered to pay up certain costs, and failing to do so, an injunction was entered against him. It now appears, however, that he has not only paid the required sum, but has himself commenced an action against the Edison-Swan Company for infringing the Zanni-Shippey patents for low resistance lamps. Mr. Shippey describes his special filament as consisting of a "composite semi-metallic substance," and perhaps in due time we shall learn what this is and what it is worth.

Mr. Harold Brown's Experiments.

Mr. Harold Brown's experiments on dogs have excited considerable interest in this country, but the general feeling appears to be that a dog is not a man, and that the sacrifice of a whole holocaust of dogs can shed but little light on the actual conditions of safety of human life, where high tension currents are concerned. The mere fact that dogs have been killed with a 160 volt alternating current seems to go a long way to show that the animal is more sensitive to electrical shocks than are ordinary human beings. At any rate there appears to be no possible room to doubt that both in this country and in your own, shocks of 1,000 volts alternating and upward have several times been sustained without serious injury. At the Grosvenor Gallery installation, where a pressure of something over 2,000 volts alternating is in use, one of the assistants recently assured me that he had several times received the full force of the machine, and that, although the experience was not an enjoyable one, he was fully prepared, in the presence of any

number of witnesses, to lay his hands on the terminals of the Ferranti dynamo. I should, of course, be sorry to encourage any foolhardy exhibition of this nature, believing as I do that the question is one in which the conditions are so complex and so variable, and which depends so much upon the temperament of the individual, that a shock, which at one time may be quite or almost harmless, may at another time prove to be of a deadly character. Meanwhile, I do not think that there is any immediate prospect of prohibitive or unduly restrictive regulations being enforced in this country; and for that reason it all the more behooves every electrician who is responsible for high tension working to adopt every possible or known precaution for the safety of human life.

Telpher Lines.

I am glad to learn that two telpherage lines have recently been ordered for some tin and copper mines in Cornwall. Notwithstanding the success of the system at Glynde, where it has now been working for nearly two years without a hitch, it has remained up to the present the sole representative of the system in England. Not long since the patents changed hands and are now owned by the "Series Traction Syndicate," for which Messrs. Manville & Madgen are engineers, and I understand that a vigorous effort will shortly be made to push forward the system with every prospect of considerable success.

LONDON, Sept. 5, 1888.

The Electrical Purification of Sewage.

At the meeting of the Institute of Sanitary Engineers held last week, Mr. Wm. Webster read an interesting paper upon his method of treating sewage by electrolysis. The Metropolitan Board of Works has already consented to allow him to carry out experiments upon a large scale at his own expense at Crossness, where the main metropolitan drainage system discharges into the Thames. The works, which are now in an advanced stage, will be capable of dealing with 1,000,000 gallons of sewage per diem. When this system first came under notice, the objection which immediately occurred to every one was that the length of time which the sewage would probably have to remain under treatment needed the construction of tanks of such enormous capacity that the expense would become absolutely prohibitory. From the figures given by Mr. Webster in his paper it would, however, appear that this is *not* the case. He believes that 100 gallons can be treated in 10 minutes, with an expenditure of energy equivalent to one-third of a horse-power; this being the brake h. p. and not the E. H. P. At this rate an engine of 25 actual h. p. would be capable of purifying no less than 1,080,000 gallons of sewage in 24 hours. The only additional working expense is the consumption of the iron, of which the positive electrode is made. This Mr. Webster estimates at one grain per gallon, and therefore plates 1 inch in thickness would last without renewal from five to twenty years. An Edison-Hopkinson dynamo has been put in, having an E. M. F. of 20 volts and an output of 1,600 ampères. It is not quite easy to understand from Mr. Webster's paper what is the exact nature of the process. It appears, however, that sewage contains so large a quantity of chlorides that the first reaction consists in the formation of hypochloric acid, which, as you are aware, is a very powerful oxidizing agent; but the acid acts upon the electrode forming hypochloride of iron, together with the liberation of hydrogen gas. The hydrogen, passing up through the liquid, carries with it the solid matter in suspension, which floats on the top as a sort of scum, and the pure liquid may be drawn off below. So great is the inventor's faith in the efficiency of his process that he expresses himself perfectly willing, nay, anxious, to make use of the effluent liquid as an article of diet!

The Postmaster-General's Report.

The interesting report which is issued annually by the Postmaster-General has just been published, and teems as usual with statistics and curious information. From this document may be gathered the somewhat ugly fact that, although the public is daily making greater use of the telegraph, yet the telegraphs only just pay their working expenses, and do not return any dividend on the ten millions sterling which were paid by the country to the companies. The sixpenny rate has doubtless a good deal to do with this state of things; it was acceded to parliamentary outcry, and would have proved still more disastrous if the clamor for free addresses had also been listened to. The real cause, however, is the huge sum paid to the old telegraph companies, and the opening of large numbers of unremunerative offices which would never have been started had the old commercial spirit still prevailed. As the public, however, demand every possible telegraphic facility, but do not seem inclined to pay proportionately, I cannot see that they have much ground for complaint at the present unremunerative nature of telegraphic business. The grand total of messages sent in the United Kingdom during the year ending 31st March last was 53,400,000, against 9,850,000 sent in 1870. In the last two years the total has increased by 14,000,000. It is a curious fact that the summer months are far more prolific of telegrams than the winter months, December only producing 4,200,000 as against 4,960,000 in August.

The British Electric Light Company.

Four or five years ago the British Electric Light Company occupied a position in this country second only in importance to that of the Anglo-American Brush Corporation. At the electrical exhibition held at the Crystal Palace in 1882 this company had one of the most extensive exhibits both of arc and incandescent lighting. Very soon it fell on evil days. The Patent Office refused to renew the Gramme patents which they held; their incandescent lamp factory did not turn out a success; and after maintaining a hopeless struggle for three years longer, in 1886 the order was issued from the Court of Chancery directing that the company should be wound up. A week or two since a circular was, however, issued to the creditors and the shareholders of the company, making the extraordinary statement that the liquidators had recently discovered that "there are good grounds for believing that the interest of the company under two licenses, one from the Edison Electric Light Company and one from the Manchester and District Electric Light Company, is now of considerable value, and that the licenses may be operated at a profit." It is, therefore, proposed that steps should be taken with a view to resuscitate the company as a going concern for the purpose of working under these licenses. At a meeting which has just been held, the creditors and debenture-holders have been induced to adopt this view, and steps are to be taken for the resuscitation of the company. As the meeting was held with closed doors I am unable at present to state or even to guess the character of the licenses which are supposed to justify this course. I am inclined to think that the whole proceeding is of a regretable nature and that both creditors and debenture-holders are simply throwing away any chance they may have had of getting their money back.

Experiments on Carbon.

The Hon. Charles A. Parsons, the inventor of the turbo-generator, has recently been engaged upon a series of experiments on the behavior of carbon under high temperatures and great pressures, with a view of producing carbon, both for arc and incandescent lighting, of the highest possible durability. The material was placed in a cylindrical steel mold of about 3 inches internal diameter and 6 inches in height, and was subjected to a pressure of from 5 to 15 tons per square inch by means of a hydraulic press. Heat was applied by an electric current of from 100 to 300 ampères. The carbon was wrapped in asbestos and an insulated wire was taken through the bottom of the cylinder and the plunger by which it was closed, and in some experiments the carbon was first coated with other substances, such as silica, alumina, carbonide and oxide of magnesia and lime. No very definite success appears to have been attained. In many cases, especially in the presence of foreign materials, the carbon was disintegrated; in others, although an increase in density was obtained, the rate of burning of the samples placed in arc lamps was not perceptibly diminished. In one case, however, in which the carbon had been surrounded with silver sand and a very powerful current had been passed through, whilst the pressure was increased to 30 tons per square inch, it appeared that the surface of the carbon had become coated with a layer or skin of very great hardness, having a crystalline structure and showing a coke like appearance under the microscope. Although Mr. Parsons does not say so in so many words, he is evidently under the impression that further experiments may result in the production of an artificial diamond by this process.

The Graphophone in England.

The Tainter-Bell graphophone has been on view for several days at the offices of Messrs. Glover & Co., in Hatton Garden, Mr. Henry Edmunds, who is a member of the above firm and is, I believe, well-known in the United States, having been appointed English agent for the Graphophone Company of Washington. On the whole, I am more favorably impressed with the prospects of the graphophone as a commercial instrument than with those of the phonograph. Possibly the musical capabilities of the Edison instrument are somewhat superior to those of the graphophone; but the greater complexity and the necessity for frequent adjustments in the phonograph, will probably prove a serious handicap in any commercial competition between the two instruments.

Magnetism and Chemical Action.

Your readers will perhaps remember that at the meeting of the British Association last year in Manchester, Professors Henry A. Rowland and Louis Bell read a paper on "The Explanation of the Action of a Magnet on Chemical Action." For some reason the publication of this interesting paper has been delayed until present time. The result of these experiments seems to prove that the points and ends of bars of magnetized iron have the power of resisting the attack of acids. This leads to the curious result that unmagnetized iron becomes electro-positive in dilute nitric or sulphuric acid toward magnetized iron. The theoretical interest of the paper is undeniable, but at the present moment it is perhaps of little practical importance.

Lighting at Barnet.

The town of Barnet has recently gone in for electric lighting on a small scale, and 71 incandescent lamps of 30 c. p. were placed in operation on Saturday evening last. Overhead wires are used, and they are taken underground wherever main thoroughfares have to be crossed. The company are putting in machinery to the extent of about 5,000 lamps for private lighting, but they will not untertake this branch of the business until the street lamps have been running long enough to give the inhabitants perfect confidence in the system.

THE TELEGRAPH.

Western Union Earnings.—The executive committee of Western Union directors have recommended the payment of the usual quarterly dividend of 1¼ per cent. The receipts of test offices the first week in September aggregated $232,000, an increase of $44,000 over last year.

Cable Laying.—Mr. Henry Stott, writing from S. S. "Minia," at Halifax, N. S., on Aug. 13, to the London *Electrician*, says: "Perhaps it might interest some of your readers to know that we used 44 knots of the Trott-Hamilton patent hemp cable on the repair of the Brest-St. Pierre cable, at a depth of 1,600 to 1,900 fathoms, with perfect success." It is understood that the repair work done this season by the "Minia" has been at once unusually arduous and effective.

Anxious Telegraph Operators.—Telegraph operators along the line of the Lake Shore & Michigan Southern Railroad are reported to be in a state of anxiety over the recent order from the company to sever their connection with the Order of Railway Telegraphers or vacate their positions. It is reported that the company has been making preparations to accomplish this for the past three months, and has secured men to fill every vacancy likely to occur under the order. A member of the Brotherhood of Telegraphers said that it was true that such order was issued. The Order of Railway Telegraphers would have to back down, for it was not strong, and its constitution prevented any strike. The men would quit the union or leave the railway service.

Liability of a Telegraph Company.—At St. Paul, Minn., on Sept. 4, the Supreme Court of the state ruled that a telegraph company is liable for the fraud and misfeasance of an agent intrusted with the duty of transmitting messages over its line, in sending a false and fraudulent message prepared by himself to a party who receives the same in the usual course of business, and in good faith acts thereon to his damage. The court held that when the local agent of a telegraph company, who was also agent of an express company at the same place, sent a forged dispatch to a merchant in the neighboring city, requesting him to forward money to his correspondent at the former place, to use in buying grain, and the same was duly received and the money in good faith forwarded by express in response to the telegram, but was intercepted and converted to his own use by the agent, the transmission of the forged dispatch was the proximate cause of the loss, and the corporation was liable, though an action might also have been maintained against the express company.

THE TELEPHONE.

Covington, Ky.—The Columbia Telephone Company has been formed by J. P. Dieter, C. H. McNeil and J. S. Freshom with a capital stock of $10,000.

Dallas, Tex.—The Dallas and Waldron Telephone Company has been formed by E. M. Jennings and others with a capital stock of $1,000 to build a line between the two places.

Mexican Telephone.—A dispatch to the Mexican Telephone Company confirms advices that the Supreme Court of Mexico has sustained the lower court in the decision favorable to this company. The Supreme Court declines to allow an appeal, which makes the decision of the lower court final.

Erie, Pa.—A special dispatch of Sept. 8 from Erie says: The courts have commenced action against the use of poles for telephone and telegraph purposes. The Grand Jury indicted the New York and Pennsylvania Telephone and Telegraph Company for obstructing the streets of North East.

Western Long-Distance Lines.—The American Telephone and Telegraph Company has begun work at the Chicago end on a new telephone line running from Chicago to Milwaukee. The line is to consist of 40-foot poles, and ten wires will be strung at once. Only copper wires will be used, and these will be worked in metallic circuit. The plan of operation will practically be the same as that in use between New York and Boston and New York and Philadelphia.

A "Burn Out" at Columbus, Ga.—A telegram from Columbus, Ga., of Sept. 11, says: The telephone wires and the electric light wires became entangled last night, while a full current was on the electric light wires. The telephone wires were melted, and night operator W. H. Galloway had a narrow escape, as the current communicated with the central office. He had the head telephone on at the time, but prompt action on his part saved his life. The head telephone and the call-wire switchboard were destroyed.

THE ELECTRIC LIGHT.

Albany, Ga.—The new Edison plant at Albany has a 100 h. p. New York Safety engine.

Biddeford, Me.—The electric light companies of Biddeford and Saco have consolidated.

Decatur, Ala.—The Decatur Electric Light and Power Company are to enlarge their plant.

Arkansas City, Ark.—The Arkansas City Gas Company are to put in a Thomson-Houston plant.

Anderson, S. C.—The hotel to be built by the Anderson Hotel Company is to be lighted by electricity.

Pine Bluff, Ark.—The plant to be built by Mr. Thomas, of St. Louis, is to have a capacity of 70 arcs and 2,500 incandescents.

Conyers, Ga.—The Stewart Paper Manufacturing Company will put an electric light plant in their paper mill and may also light the town.

Chicago, Ill.—The Peoples' Light and Power Company, of Chicago, has been formed by C. P. H. Dese and others, with a stock of $100,000.

Tarentum, Pa.—The Tarentum Electric Light Company has been incorporated by J. H. Humphreys and others with a capital stock of $5,000.

Concordia, Kan.—The Concordia Electric Light Company has been incorporated by M. M. Spaulding and others, with a capital stock of $20,000.

Aberdeen, Miss.—Messrs. Paine and Dalton wish to get propositions on a plant of about 25 arcs, and to include incandescents. The plant is for the city.

Washington, D. C.—Mr. E. Clark, the architect for the Capitol, has recommended the purchase of three boilers of 100 h. p. for the new electric light plant.

Jackson, Miss.—Messrs. Chiles, Watkins and Lemon have been appointed a committee by the city council to examine the different systems of electric lighting.

Suwanee, Fla.—The Suwanee Sulphur Springs Company are desirous of purchasing electric light, bell and annunciator outfit, with steam engine, boiler, etc.

Centralia, Ill.—Mr. Joseph Benson has recently increased his electric light plant by purchasing a number of 2,000 c. p. arc lamps from the Brush Company of Cleveland.

Greenville, Miss.—The Greenville Electric Light and Power Company, which has adopted the Edison system, will begin operations this week with 800 lights subscribed for.

The Page Belting Company reports business active. An interesting order that it filled not long since was for the electric light station of the Fitchburg road at the Hoosac tunnel.

Jamestown, N. Y.—Mr. T. H. Smith, Jamestown, N. Y., has recently increased his electric light plant by purchasing 12 arc lamps from the Brush Electric Company, Cleveland.

Philadelphia.—The Brush Electric Light Company, Philadelphia, Pa., have recently increased their electric light plant by purchasing a large number of arc lights from the parent company.

Etna, Pa.—The Isabella Furnace Company, Etna, Pa., have recently increased their Brush electric light plant by the addition of a number of arc lamps from the Brush Electric Company of Cleveland.

Forestdale, R. I.—The Forestdale Manufacturing Company will light its mills in the future by 300 incandescent lights. A 45 horse-power Westinghouse engine will furnish the power to run the dynamo.

Tonawanda, N. Y.—The Standard Gas Company, of Tonawanda, N. Y., has been incorporated, with a capital of $25,000. Its object is to manufacture and supply gas and electricity in Wheatfield and Amherst.

Leavenworth, Kan.—The Leavenworth Water-Works Company, Fort Leavenworth, Kan., have recently increased their incandescent plant by purchasing a new incandescent dynamo from the Brush Electric Company.

Niagara Falls, N. Y.—The Brush Electric Light and Power Company, of Niagara Falls, have again increased their electric light plant by purchasing a number of 2,000 c. p. arc lamps of the Brush Electric Company, Cleveland, O.

Newark, N. J.—The Schuyler Electric Light Company will erect a two-story brick building, 40 × 70, on Nutria street. The United States Electric Lighting Company will erect a four-story building on Plane street and M. & E. R. R. avenue.

Brooklyn, N. Y.—The New York Safety Steam Engine Company has supplied a 125 h. p. high speed horizontal automatic for the Pratt Institute to run incandescents, and two 30 h. p. of the same style for the Excelsior plant of S. Wechsler & Brother.

Pittsburgh, Pa.—J. E. Ridall, representing the Brush Electric Company in Pittsburgh, has recently sold an electric light plant to the Pittsburgh Traction Company, consisting of a 30-light, 2,000 c. p. arc dynamo, with a full complement of lamps.

Pottstown, Pa.—Edward W. Tisdall, representing the Brush Electric Company in Philadelphia, has recently sold a complete incandescent electric light plant, consisting of 225 incandescent lights, to the Ellis & Lessig Steel and Iron Company, Pottstown, Pa.

West Lynn, Mass.—Besides purchasing the Johnson estate at West Lynn, Mass., the Thomson-Houston Electric Company has bonded the Phillips estate on Waterhill street, and is reported to be negotiating for the Berry estate on Federal street.—*Mfrs. Gaz.*

A Western Railroad.—The Duluth, South Shore & Atlantic Railroad Company, of Marquette, Mich., have, during the past week, increased their arc light plant by purchasing a number of arc lamps from the Brush Electric Company, of Cleveland, Ohio.

Burlington, Vt.—The Burlington Gas Light Company, Burlington, Vt., have recently made quite an addition to their electric light plant. The Brush Electric Company has furnished them with a 30 light 2,000 c. p. arc dynamo with full complement of lamps.

Spartanburg, N. C.—The Spartanburg Gas, Electric Light and Power Company has been incorporated by A. E. Moore and others with a capital stock of $20,000. The local gas works will be bought and remodeled and an electric plant will be added.

Wauwatosa, Wis.—The work of erecting the electric light plant at Wauwatosa, a suburb of Milwaukee, has just begun. The plant will include arc and incandescent systems; the arcs to be used for the streets and the incandescents in lighting residences.

The Hoosac Tunnel.—A number of men working on the electric light installation, etc., in the Hoosac Tunnel were prostrated last week by gas from passing locomotives. It might be well to include motors in the lighting plant to ventilate the tunnel.

Jamestown, N. Y.—The Jamestown Electric Light and Power Company represents the consolidation of the two local companies previously existing. The president and general manager is Mr. C. W. Grant, and the secretary and treasurer is C. H. Tew.

Huntington, W. Va.—The designs submitted by the Hill Clutch Works, of Cleveland, O., to the Huntington Electric Light and Street Railway Company for their new station, have been accepted and the contract awarded to them. The work will be done at once.

Fostoria, O.—The Fostoria Electric Light Company have recently increased their plant by purchasing a number of arc lamps from the Brush Electric Company, Cleveland, Ohio. This company is now operating about 100 Brush arc lights and a number of Brush incandescents.

Baker City, Ore.—The Baker City Gas and Electric Light Company has been organized, with a capital stock of $50,000, by J. H. Parker, J. P. Faull, J. W. Wisdom, C. F. Hyde, H. Rust, O. M. Dodson and E. H. Mix, to build and operate electric light and gas plants in that place.

Disruptive Discharges.—Mr. E. G. Acheson writes with regard to his electric light convention paper that the passage, "the charge being expressed in coulombs, and the capacity in microfarads," should read, "the charge being expressed in coulombs and the capacity in farads."

Griffin, Ga.—W. J. Kincaid, J. M. Brawner, S. Grantland, A. Randall and others have formed the Griffin Light and Water Company with a capital stock of $25,000, to erect an electric light plant. They will use the Edison system. They are privileged to build water and gas wooks, but do not contemplate doing so at present.

Jamestown, N. Y.—Mr. W. F. Endress, of the Jamestown Electric Light and Power Company, was recently presented by the employés of the company with a gold locket on the occasion of his leaving the town to undertake electrical work elsewhere. The presentation was made by Mr. George Hoffman, the electrician of the company.

New York City.—The Mount Morris Electric Light Company, of this city, have just bought 100 miles of Nos. 4 and 6 B. & S. patent K. K. weatherproof line wire from Holmes, Booth & Haydens, through Mr. Theo. Larbig. This big order is intended for trunk lines on the west side, six wires being run from Battery Place to 155th street.

Marysville, Kan.—The Marysville Electric Light Company have recently purchased a large arc and incandescent plant from the Brush Company, of Cleveland. The installation of the plant is about completed. All the lights originally ordered have been placed, and the company have ordered an additional number of arc lights from Cleveland.

Durham, N. C.—J. S. Carr, of Durham, and H. Leftwick, of Greensboro, lately mentioned as purchasing the plant of the Durham Electric Light Company and to add gas works, have, with others, organized the Durham Gas Company with a capital stock of $60,000. They will build works at once. Mr. Carr is President, and George W. Watts, Vice-President.—*Mfrs. Record.*

Philadelphia.—John Wanamaker has just purchased of the Brush Electric Company thirty 2,000 c. p. double arc lamps for the purpose of increasing his electric light plant, which now consists of 300 Brush arc lamps and two or three hundred Brush incandescent lamps. This plant is now much larger than many of the central stations throughout the country, and has been in operation for a number of years.

Baltimore, Md.—Robert Rennert, John S. Crowthers, Edward L. Tunis, Benjamin Blum and Joseph B. De Lery have incorporated the Wenstrom Southern Electric Manufacturing Company, to manufacture electric appliances, furnish electricity for light and power purposes, etc. The capital stock is $100,000. They have rented the machine works formerly operated by the H. A. Ramsay Manufacturing Company.

Los Angeles, Cal.—The depot and surroundings are to be lighted by a combined arc and incandescent plant manufactured by the Waterhouse Electric and Manufacturing Co., of Hartford, Ct. It will consist of eight double arc lamps, twenty-four 25 c. p. and ten 100 c. p. incandescent lamps. A fine exhibition was made of this plant before shipment from the factory, the incandescent lights burning perfectly steady upon the arc circuit.

Hoosick Falls, N. Y., now has a Thomson-Houston plant of 60 arc lights in successful operation, driven by a 100 h. p. boiler and a 50 h. p. Armington-Sims engine. Incandescents are to be introduced, and water-power will be used. The officers of the Hoosick Falls Electric Light and Power Company are: President, Hon. S. D. Locke; treasurer, Frank Sawyer; superintendent, John T. Sawyer; engineer and electrician, O. W. Morrison; and E. W. Day, formerly of the Franklyn Electric Light Company, assistant.

Struck by Lightning.—The stone building occupied by the central station of the Haverford Electric Light Company at Ardmore, Pa., was struck by lightning and set on fire at an early hour on Sept. 13, and completely destroyed. The dynamos and all the machinery, with the exception of two boilers, were also completely wrecked. The entire loss is placed at $15,000, upon which there is $3,000 insurance. As the storage battery system is used by the company, the majority of the consumers will not be deprived of light, as there is a sufficient charge in most of the batteries at their residences to supply them until the machinery is again in operation.

APPLICATIONS OF POWER.

Harrisburg, Pa.—The Sprague cars on the Harrisburg Street Railway have been in operation for about a month, and prove very satisfactory. The equipment consisted of six cars and overhead wiring.

Akron, Ohio.—Work on the new Sprague electric road is being pushed forward as rapidly as possible. The system will be overhead and the small bronze No. 6 wire in use upon all the Sprague roads will be used. The first portion of the equipment will consist of ten cars.

A Wonderful Showing.—The Sprague Electric Railway and Motor Company since the last issue of this paper has closed the twenty-sixth contract for equipment of railroads on the Sprague system. This is simply the record of the last six months. On the first of February the Sprague Company had not a single road in operation.

Providence, R. I., has recently been discussing the plan proposed by Mr. R. A. Denison, of that city, to operate a road on College Hill by electricity, using a single 15 h. p motor, obtaining current from 150 cells of Gibson's storage battery as well as current direct from a special form of composite rail in the shape of a light conduit.

New Orleans, La.—Mr. W. Oswald, agent for the Sprague Company, has just put in a 3 h. p. Sprague motor at the printing office of Hunter & Enslinger to run a half medium nonpareil press, a Whitlock drum-cylinder press and three quarto nonpareil presses. This makes the sixty-fifth Sprague motor running in New Orleans, and all are reported as giving satisfaction.

The Bentley-Knight Company.—At the meeting of the stockholders of the Bentley-Knight Electric Railway Company, held recently in this city, the following officers were elected: R. W. Blackwell, president and treasurer; J. L. Blackwell, secretary; G. Renault, E. M. Bentley, W. H. Knight, L. C. Delmonico, F. H. Howell, R. R. Hazard, and G. J. Blackwell, directors.

The Baxter Motor.—Although the Baxter motor has only been on the market a little over a year its popularity as a motive power has far exceeded the good results and patronage attained upon the introduction of the Baxter engine. The sales of the Baxter motor to-day number more than double those of the Baxter engine in its most prosperous period. The Baxter engine owes its title as the invention of the father, the Baxter motor being the invention of the son.

West End, Boston.—The railway directors have considered a proposition from the Thomson-Houston electric people to run the railway line between Arlington and Cambridge by electricity until June. The proposition is for the electric company to operate the line, the railway company to furnish drivers or conductors and to keep the body of the cars in good repair, and to allow the electric company a certain sum for operating, which sum is less than the present cost. The railway company will receive the profits, and, if the experiment is a success, will buy the electric plant at an agreed price. If it becomes necessary to use horses before June the electric company will furnish them. This is the general proposition, as it is understood, and it was referred to the executive committee with power.—*Boston Herald.*

PERSONALS.

Mr. W. F. Endress has recently resigned his position as secretary and manager of the Jamestown, N. Y., Electric Light and Power Company.

Mayor Hewitt says that ex-Governor Cornell is "an ass," and adds: "He is interested in a low current electrical company. He wants me to break up everybody else, and give his company the whole thing."

Ex-Gov. A. B. Cornell, who sent a letter to the papers recently suggesting that high tension currents should be prohibited, has been interviewed on the subject and again offers the same remedy. He favors the enactment of a law by the legislature which shall absolutely prohibit the use of circuits of such high tension as will endanger human life and property. His idea seems to be to lower the number of arc lights to be burned on any circuit and thus reduce the E. M. F.

Mr. E. P. Roberts, a graduate of the Stevens Institute of Technology, and until recently in charge of the large Brush plant at Cheyenne, Wyo., as well as of other installations, has been appointed assistant professor of electrical engineering at Cornell University. The selection must commend itself to all familiar with Mr. Roberts' ability as a theoretical and practical electrician, and is another indication of the sound and vigorous policy now controlling affairs at the university.

MISCELLANEOUS NOTES.

The Hauss Electric Company, of Jersey City, N. J., has been incorporated by J. L. Zerbee and others with a capital stock of $250,000.

Framingham, Mass.—The Electric Company, of Framingham, has been formed by E. J. Garfield and others, with a capital stock of $60,000.

Milwaukee, Wis.—The Dominion Automatic Fire Service Company, of Milwaukee, has been formed by W. Sanderson and others, with a capital stock of $100,000.

The National Conduit Manufacturing Company, of Hastings, N. Y., has been incorporated by C. H. Jackson and others, with a capital stock of $100,000.

Electric Matrices.—The New England Electric Matrix Company, of Portland, Me., has been formed by C. M. Gage and others, with a capital stock of $1,000,000.

An Electric Drill weighing 100 pounds and that makes a hole three feet deep in hard anthracite in 30 seconds and one six feet deep in 1½ minutes is the latest thing in electric drilling machines. It is designed by Mr. W. M. Schlesinger and made by the Union Electric Company, of Philadelphia.—*Ex.*

The Cincinnati Electric Club.—A number of gentlemen met at the Board of Trade, Cincinnati, last week, for the purpose of organizing an electric club, which is to be beneficial and instructive to those interested in the advancement of electric science. About 56 members subscribed. The following temporary officers were appointed: Chairman, A. R. Foote; secretary, Thomas Nicholson. A committe was appointed on constitution to report at the next meeting.

The Taylor Tootometer.—Mr. F. B. Taylor, the inventor of the socophone, an instrument for transmitting messages to and from engineers while under full speed on their locomotives, has recently brought out a device which he calls a tootometer. It is a species of phonograph, but makes the record on a long roll of tinfoil of all the whistle-blowing by a locomotive. The tinfoil is run off its roll in correspondence with the movement of the engine, and in the event of anybody being injured or killed at the grade crossings the tootometer record will show whether or not the whistle was blown. This is a point often disputed in suits against railroads for damages, and Mr. Taylor thinks that his instrument will save the companies a good deal of money and cut down the quantity of false swearing done.

A State Weather Bureau.—The preliminary work of establishing a bureau of weather service for this State is now in progress at Cornell University, Ithaca, N. Y. Cornell University is to be the central office of the State, because of its fine equipment for the investigation of atmospheric phenomena. General Greely has sent one of his subordinates to organize this State service under the direction of Professor Fuertes. The signal code of the university is being changed to correspond with those of twenty States now provided with like service. From 100 to 150 telegrams making special forecasts for various portions of the State will be sent from Cornell to the lakes, the interior and the seaboard. The present signal station on the campus will give place to a new library building, already staked out, and flags will be exhibited from a staff on McGraw tower.

Political Speeches by Phonograph.—A special dispatch from Toronto, Can., of Sept. 8, says: "The Mayor of the city has written to the managers of the Industrial Exhibition, which opens on Monday, requesting that no politics be imported from the United States in the Edison phonograph, which, among other novelties, is to be on exhibition here. The proposition to invite Mr. Erastus Wiman, of New York, to deliver an address on Farmers' Day, on "Commercial Union with the United States," having been voted down in the Board of Management by the manufacturers, who fear the free introduction of American goods, it was suggested that Mr. Wiman should repeat into the phonograph in New York, prior to its departure for Canada, some strong sentences in advocacy of his pet idea, and thus adroitly circumvent the opposition. The Mayor, however, protests, as he fears it would mar the harmony of the proceedings, and Mr. Wiman has been asked to make a short speech on some subject other than that of obliterating the barriers between the two countries. This he has consented to do, and the Mayor and manu-

facturers rests in peace, at least for the time being." Mr. Wiman's speech, however, was pretty lively after all.

Clara Morris' Phonograph.—An automatic teacher of elocution is being suddenly employed by a number of actors and actresses. It is the phonograph. The example was set by Clara Morris. She obtained a phonograph a month ago, and used it to ascertain exactly how her speech sounded. She had become convinced that no speaker hears the tones of his own voice exactly as others do, and it occured to her that if she spoke into a phonograph she could get a correct idea of her vocal expressions. She found that the plan worked well. She would recite portions of her roles, and then have it repeated again and again by the machine. Although the mechanical voice lacked in volume, its mimicry of emphasis, inflection and other qualities was precise. The news of Miss Morris' experiment got out, and now there can be counted up a dozen players who, in studying their parts in plays to be produced next season, are using phonographs.—*New York Sun.*

BUSINESS NOTICES.

Jordan & Gottfried, 208 Canal Street, N. Y., carry a complete stock of iron and brass machine and wood screws, bolt, cap and set screws, taps, dies, files, twist drills, brass and rubber tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

The Partz Electric Battery Company, of Philadelphia, having found their old quarters at 1,723 Chestnut street too small, have leased the large building at 636 Arch street, same city. They are now prepared to fill all orders promptly, and in addition to their large line of Open Circuit and Gravity and Motor Batteries, have a full line of small Motors and Dynamos. Send for their price list and catalogue, or write to them stating what you want.

Ball Engines.—The Ball Engine Company, of Erie, Pa., whose New York agents are Charles R. Vincent & Co., 15 Cortlandt street, New York, has just issued a new descriptive catalogue of their engines, which ought to be in the hands of purchasers of engines and all interested in steam power. The catalogue not only enters into some very interesting details as to the various features of this excellent engine, but includes a number of tables, rules for computing horse-power, water consumption etc., and some suggestive indicator cards.

"Vacuum" Feed-Water Heaters.—Warren, Webster & Co., of 491 Third street, Philadelhhia, issue a neat pamphlet giving details as to their "Vacuum" feed-water heater and purifier. The principle consists in converting the water to be purified into vapors, and reconverting the vapors back into a liquid state by the water next entering to be purified, preventing loss of heat units. The "Vacuum" is in use by the Edison Company at Lancaster, Pa.; the Gloucester, N. Y., Electric Light Company; the Wissahickon Electric Light Company, Philadelphia, and in several other plants, with, it is understood, highly satisfactory results.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS ISSUED AUGUST 28, 1888.

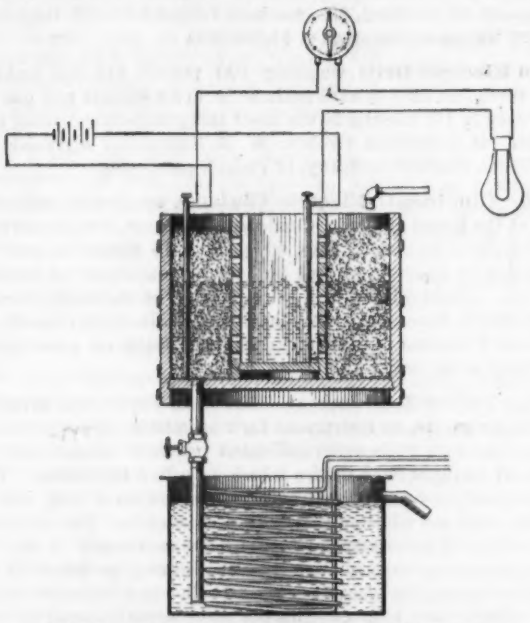
388,381. Telegraph; P. B. Delany, New York, N. Y. Application filed Dec. 3, 1887. Claim 1. The combination of a main line, transmitting mechanism for sending alternating currents over the line, receiving polarized relay, a moving contact maker connected with the line, its actuating mechanism controlled by the relay and contacts connected with sources of energy of opposite polarity, over one of which contacts the trailer passes at each movement of the relay armature, whereby a current is sent into line after each received impulse.

388,430. Galvanic Battery; A. V. Meserole, New York, N. Y. Application filed May 18, 1888. Two electrolytes composed respectively of sulphate of mercury in dilute sulphuric acid and nitrate of mercury in dilute nitric acid. The invention also embraces the structure of the cell. See illustration.

388,438. Circuit-Changing Device for Burglar Alarms; Frank H. Nutter, Malden, Mass. Application filed June 25, 1888. The invention consists in a fixed contact spring and a suitable support therefor, a rotatable and laterally movable support, and a contact arm or pin carried by it.

388,442. Underground Electric Conduit; Edward H. Phipps, New Haven, Conn. Application filed April 4, 1888. A conduit having a series of parallel passages. Between the abutting ends is placed a perforated disc forming one member of a universal joint, the other member being the end of one of the abutting sections.

(1) 388,453. (2) 388,454. (3) 388,791. (1) Loop-Key; (2) Electric Resistance Measuring Apparatus; (3) Switch-Board for Telephone Exchanges; Charles E. Scribner, Chicago, Ill., Assignor to the Western Electric Company, of same place. Applications filed respectively June 1, 1888; June 1, 1888, and March 22, 1884. (1) The invention



388,592. ICE OR REFRIGERATING MACHINE.

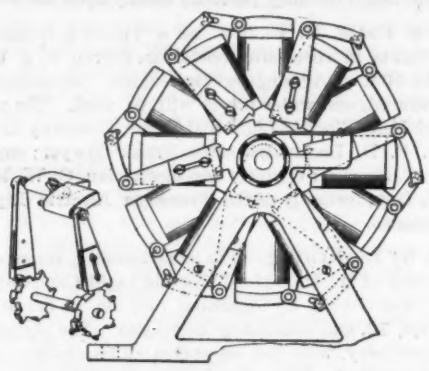
consists essentially in a loop-key adapted to connect and disconnect a telephone from circuit or make connection with a generator. (2) A resistance-measuring apparatus consisting essentially of a circuit including two batteries of substantially equal electromotive force and a rheostat, a shunt wire, including a current-indicating apparatus connected between the batteries at one end and at a point of the circuit beyond the rheostat at the other end, and a connecting device for closing the circuit with the circuit to be tested. (3) Switch boards, each having the usual switching apparatus and its group of telephone lines, and trunk lines between said boards in combination with half connection or branch terminals, placed within reach of the switchmen at the different boards, whereby any switchman may test to determine whether any line of another group called for at his own group is busy.

388,477. Electrical Conductor; Wm. A. Conner, Pittsburgh, Pa. Application filed Feb. 21, 1887. An electric cable having a central conductor-core and a number of insulated conductors, arranged spirally around the central conductor, and each having a cross-section greater in breadth than thickness and composed of a number of wires.

388,482. Dental Electric Apparatus; Charles A. Eisenhart, York, Pa. Application filed Jan. 3, 1888. This is an arrangement of medical battery, wherein two or more cells are employed, one of which is adapted for open circuit work and another to maintain the current at a sufficient degree of constancy for maintaining at incandescence during short periods a small mouth lamp. The invention consists in the mechanical details which are intended to render the apparatus easier to control and give it a wider range of use.

388,487. Suspending Overhead Electric Wires. Alfred E. Harris, London, England. Application filed March 4, 1887. Patented in England, Dec. 29, 1886, No. 17,052. Attached to the telegraph poles upon opposite sides are two bars held in a certain position by springs. The arrangement is such that the springs will give under a heavy tension caused by stress of weather.

(1) 388,512. (2) 388,513. (3) 388,514. (4) 388,746. (1) Electric Motor; (2) Commutator for Dynamo-Electric Machines; (3) Electric Tram Car; (4) Electrode for Storage Batteries; Jean T. Van Gestel, New York, N. Y., Assignor of 1, 2 and 3 to the Van Gestel Manufacturing Company, of New York. Applications filed for 1, 2 and 3, Sept. 10, 1887, and for 4, Nov. 10, 1887. (1) The field magnets are shaped like horse-shoes, and the disc armature runs in semi-circular channels formed in the faces of the pole pieces. (2) A collector or commutator for dynamo-electric machines or electric motors, consisting of a worm-gear placed upon the armature shaft of the machine, the face of the gear being composed of bars of copper or other suitable material mutually insulated and placed parallel with the shaft, the same being connected severally with the different coils of the armature,



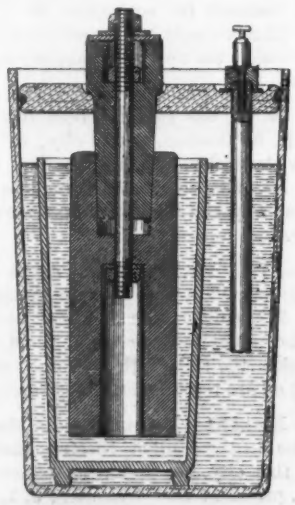
388,573. ELECTRIC MOTOR.

and two collector-wheels of similar conductive material having teeth which correspond and mesh with the thread of the worm placed on diametrically opposite sides of the worm, and having their axes at right angles with the worm-shaft, the said wheels being connected with the two extremities of the external electric circuit. See illustration. (3) The motor is mounted upon a detachable platform suspended beneath the car from the car axles. (4) The covering of the plate is of lead or lead alloy integral throughout, united at openings through the base plate from opposite sides, and provided with receptacles for the active materials.

388,538. Traveler or Trolley; Leo Daft, Plainfield, N. J. Application filed Jan. 4, 1887. The trucks of the trolley are mounted in extension journals, so that two trucks running side by side upon parallel wire may adjust themselves to inequalities in the space between the conductors.

388,581. Electric Belt; Harry P. Pratt, Chicago, Ill., Assignor to the Pratt Electric Therapeutic Supply Co., of same place. Application filed April 10, 1888. The links of the belt are formed of expansible and compressible battery cells.

388,583. Electric Meter; Karl Raab, Kaiserslautern, Bavaria, Germany. Application filed Feb. 27, 1888. A meter in



388,430. GALVANIC BATTERY.

which the current heats a coil of wire, causing a draught of air which operates upon the veins of an anemometer.

388,592. Ice or Refrigerating Machine; John E. Sieble, Chicago, Ill. Application filed April 19, 1888. Positive and negative electrodes are arranged within the machine whereby water containing a substance having a corroding effect upon metal, passed into contact, with the electrode is prevented from corroding the coil. See illustration.

388,594. Electric Arc Lamp; Lewis W. Spencer, of Hoosick Falls, and Frederick P. Jaquith, Hoosick, N. Y. Application filed Oct. 12, 1885. A shunt magnet operates a pawl and ratchet, and they in turn move a nut located upon the threaded carbon rod.

388,601. Electrode for Secondary Batteries; S. L. Trippe, St. Louis, Mo. Application filed June 10, 1887. An electrode composed of an exterior perforated plate or envelope having attached to it internally a suitable conducting wire and an interior perforated and corrugated plate, there being a suitable composition between the plates, and the whole being held or pressed together.

388,622. Electric Motor for Self-Winding Clocks; F. W. Brainerd, Chicago, Ill. Application filed May 25, 1888. An electric motor armature for winding a clock has a detent for arresting the armature in a predetermined position with reference to the magnetic field of the motor upon its retrograde movement.

388,628. Process of Making Battery Zincs; Robert L. Carr and Parker Borden, Fall River, Mass. Application filed Dec. 15, 1887. A process of joining a head or cap carrying a connection wire to the body of the zinc.

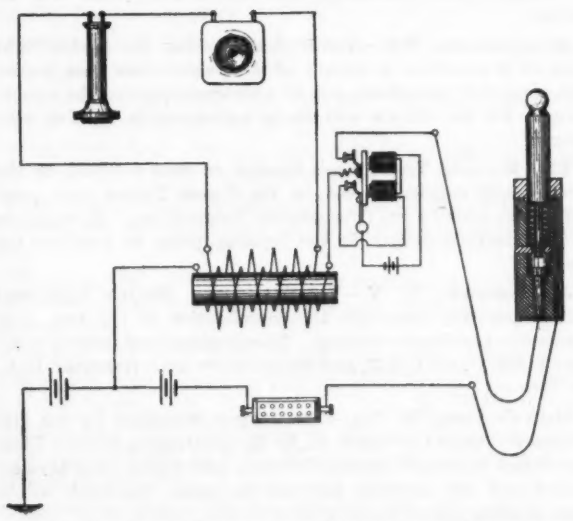
388,631. Electric Fire Alarm Signal Box; Sidney A. Chase, Evart, Mich. Application filed March 31, 1888. There is arranged within the box two springs, forming a part of the circuit. The springs have attached to them blocks of insulating material, having openings adapting them to receive and interlock with the key.

388,668. Storage Battery Plate; Chas. D. P. Gibson, New York, N. Y. Application filed April 23, 1888. The openings in the plate have inserted into them buttons of the same material. The buttons have enlarged heads and inclosed between them is the active material.

388,690. Electric Railway Station Indicator; George H. Kirnan, Wilkesbarre, Pa. Application filed March 27, 1888. The current is used to start a clockwork into operation which exhibits the name of a station. An electric bell is also connected with the device.

388,697. Arc Lamps; John Lea, London, England, Assignor to Hugh Watt, of same place. Application filed Jan. 19, 1888. Patented in England March 12, 1887. The brake controlling the feeding clockwork is actuated by a magnet in a shunt circuit.

388,707. Electric Meter; Henry G. Morris, of Philadelphia, Pa., Assignor to the Grove Electric Company, of same place. Application filed Feb. 25, 1888. A magnet for actuating the registering mechanism, a commutator controlling the magnet, and having independent terminals connected to different lamps in the system, an actuating spring for the commu-



388,454. ELECTRIC RESISTANCE MEASURING APPARATUS

tator, an electric motor and winding gear operated thereby and connected to the commutator-actuating spring.

388,723. Electric Arc Light Support; Benjamin Schardt and Geo. Jones, of Dayton, O., Assignors of one-third to John R. Fletcher, of same place. Application filed Jan. 25, 1888. Structural details relating to the lamp hood.

388,573. Electric Motor; John Batley, Philadelphia, Pa Application filed June 29, 1887. The object of this invention is to employ the direct attraction of the armatures of a series of electro-magnets to vibrate a series of levers, which in turn cause a rotary movement of the motor-shaft. The magnets are arranged or coupled in two series, which are adapted to become energized alternately, and each of the electro-magnets is preferably supplied with electrical current from a separate battery. By cutting out one or more of the batteries the corresponding electro-magnets are cut out, and hence the power of the motor may be correspondingly increased or decreased. An important feature of the construction is that the operating-levers which act on the motor-shaft are caused to operate automatically, whether their operating magnets are energized or not, so that all of the moving parts shall maintain a constant relation with each other and all danger to breakage due to irregular movements become obviated See illustration.

388,757. Furnace for Baking Electric Light Carbons; John Burns, Rochester, N. Y., Assignor of one-half to Roland W. Fredericks, of Lock Haven, Pa. Application filed April 4, 1887. The novelty lies in the construction of the ends of the retorts. The ends are beveled at the top and bottom, and are inserted into grooves in the masonry.

388,803. Railway Telegraphy; Granville T. Woods, Cincinnati, O. Application filed July 14, 1887. A transmitting and receiving coil having its convolutions brought into planes approximately parallel with the line conductor.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, N. Y.